Our Land, Our Value
Valuing Natural and Social Capital in Rural Lands

Learning Report, October 2017

Indufor

FES
FOUNDATION FOR ECOLOGICAL SECURITY

Ulster University

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Cover photo by Anil Sarsavan: Woman carrying fuelwood in Mukungarh, Rajasthan, India, June 2016.

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About Indufor North America

Indufor North America is part of the Indufor Group, which is an international forestry and natural resource management consulting group with offices in Finland, New Zealand, Australia, and the United States. The group provides advisory services to private and public-sector clients in sustainable natural resource management, encompassing valuation and investment, forest industry and bio-solutions, resource mapping, climate change, and development consulting.

About the Foundation for Ecological Security

The Foundation for Ecological Security (FES) is a non-profit organisation based in Anand, Gujarat, India working towards the ecological restoration and conservation of land and water resources in ecologically fragile, degraded and marginalised regions of the country, through concentrated and collective efforts of village communities. FES has played a pioneering role in furthering the concept of the Commons as an effective instrument of local governance, as economic assets for the poor and for the viability of adjoining farmlands.

About Ulster University

Ulster University is a UK-based higher education establishment that delivers world-class teaching and education with an applied focus. It has an international reputation for research excellence, innovation and regional engagement. The Built Environment Research Institute has extensive expertise in property appraisal, regeneration, value creation and innovative funding mechanisms. The land and property education at Ulster is accredited by the Royal Institution of Chartered Surveyors.

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Responsibility for any errors rests with the authors alone.

Custard apples, Kyara ka Khet, Udaipur District, Rajasthan, India. Photo by Indufor North America.

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Abbreviations and Acronyms

CAMA	Computer-assisted mass appraisal
DCF	Discounted cash flow
DLC	District Land Committee
FES	Foundation for Ecological Security
FPIC	Free, prior, and informed consent
GIS	Geographic Information Services
IAAO	International Association of Assessing Officers
JFM	Joint forest management
LIDAR	Light detection and ranging
NDVI	Normalized Difference Vegetation Index
NGO	Non-governmental organization
NPV	Net Present Value
NRCS	Natural Resources Conservation Service
NREGA	National Rural Employment Guarantee Act
NTFP	Nontimber forest product
ODK	Open Data Kit
PES	Payment for ecosystem services
RVT	Rural Valuation Tool
STL	Seasonal-Trend decomposition procedure based on Loess
USGS	United States Geological Survey
VFPMC	Village Forest Protection and Management Committee
WTA	Willingness to accept
WTP	Willingness to pay

Running the tap, Mukungarh, Bhilwara District, Rajasthan, India. Photo by the Foundation for Ecological Security.

Foreword

Imagine a world in which people live on their land for generations, pass it to their heirs, cultivate it, and treasure it—but where the idea of establishing a dollar or rupee amount for their property is uncommon and unnatural.

Now, imagine what happens when this world collides head-first with the forces of globalization and foreign direct investment, the pressures on land caused by climate change and population shifts, and the rise of new economic opportunities. New faces show up in rural villages in Tanzania or favelas in Rio de Janeiro or indigenous communities in the Amazon Rainforest, seeking access to people's property and offering compensation.

The result? For the first time, many individuals and families are faced with the question, "How much can I pay you for your property?" And answering the question is far from simple.

These are communities that have never previously considered selling their land. Some do not know or cannot prove the economic and financial value of their land and property. There may be no formal property market where they live, or the rights to their property may be unclear, undocumented, or not legally recognized. Some fear that talking about land value might lead to dispossession. And what's more, in many places, the value people place on land is not merely economic but also cultural and spiritual.

Against this backdrop, land valuation may also serve as a tool for strengthened tenure, personal and community empowerment, and improved communication between communities and external groups.

This state of events is what inspired Indufor North America, together with the Foundation for Ecological Security (FES), Ulster University, and Omidyar Network, to ask a new set of questions:

- What if people were able to estimate the value of the land they use and manage, based on the economic, natural, and social factors that are most important to them?
- What if we could empower people with a new kind of land valuation tool? One that is accessible and easy to use for its users. A tool that doesn't just rely on a comparable sales or replacement cost approach, but actually takes into account the broader range of natural and social capital unique to the communities using it.

The data generated from a land valuation tool could empower people to negotiate with government and industry to stay on the land, get the value they deserve for their land, or to make an educated choice about how to better manage or let go of land. The data could inform future land use decisions by current users, for example, by households or communities that rely on land-based resources and income generation for a major portion of their livelihoods. In cases where people have altered or plan to alter their resource management regime, valuation could be done before and after to understand the impact of their decisions.

Such a land valuation tool could be game changing, particularly in rural areas in emerging markets susceptible to land speculation and where land is undervalued or not yet valued by the market. It is this potential that inspired a new report by Indufor, exploring whether it is possible to develop such a tool. The report contains Indufor's initial findings on the state of play in valuation of natural capital and social capital, and provides an overview of the methodology and field-testing in several communities in Rajasthan, India of a new Rural Valuation Tool, developed in partnership with FES and Ulster University.

The Rural Valuation Tool draws inspiration from Namati's community-oriented Community Land and Natural Resource Valuation Activity, a bottom-up approach that seeks to empower local users to better manage and maintain their lands. Indufor's research also looked at the potential for geographic information systems (GIS) and remote sensing to validate findings as well as infer the value of land across much larger areas, informed by the Computer-Assisted Mass Appraisal (CAMA) approach.

At Omidyar Network, we invested in this research because we value the power of people to safeguard their assets and take land management decisions into their own hands. This fundamental right sits at the heart of nearly every other global development issue, from gender equality to environmentalism. We also recognize the potential danger of putting a monetary value on something that has long been presumed invaluable, opening communities up to potential dispossession and conflict.

However, we cannot ignore the ways in which the world is changing. What we can do is prepare and empower those that will be affected. And this research is a first step. We aim to equip populations with the tools and information they need to make informed decisions about their land and property for their own economic and social empowerment. If and how individuals and communities choose to use the tool is their decision.

We look forward to sharing the Rural Valuation Tool and its potential applications with people across the property rights, investment, environmental conservation and global development communities. Our hope is that these broader learnings on rural valuation will provide a foundation for future inroads in rural property rights and improved livelihoods.

Peter Rabley
Venture Partner, Property Rights
Omidyar Network

Livestock grazing, India. Photo by the Foundation for Ecological Security.

Executive Summary

The current dearth of information on rural land across the world often leaves households and communities vulnerable to speculation, power struggles with government and the private sector, and missed opportunities to benefit from their natural capital. When faced with outside interest in their resources, rural residents may find themselves ill-equipped to defend their claims to continue using the land, or to negotiate fair compensation.

An underlying factor behind this is the difficulty of determining rural land prices using valuation approaches that use traditional indicators. As the area of land and natural resources under commercial investment grows, this raises widespread concern—and a need for an innovative approach to capture the full value of land.

Indufor undertook a comprehensive review of existing approaches currently used to value ecosystems, presented in this report. We found that these valuations are based on land market information that is limited for rural areas. They also ignore intangible benefits derived by residents from their land, and fail to capture the disconnect between legal land use classifications and the way land is actually used. Moreover, they tend to overlook land tenure rights, which can cause conflict between occupants and rights holders. Based on its findings, Indufor determined a need for a more targeted valuation tool that efficiently integrates market and non-market methods to value rural land.

In response, Indufor partnered with the Foundation for Ecological Security (FES) and the Ulster University to create an innovative approach to evaluating land, with support from Omidyar Network. The Rural Valuation Tool provides a bottom-up platform that can be used by individuals, communities, NGOs, or cooperatives to measure the true value that residents derive from a land parcel, also capturing an approximate level of tenure security over that parcel. It is especially suited for valuing land that lacks a clear market value, avoiding reliance on conventional real estate indicators and employing a more diverse set of indicators.

The tool was piloted to value six commons used by six villages in Rajasthan, India in collaboration with FES, which has decades of experience working with communities across rural India. In addition to conducting community-based surveys, the team investigated how remote sensing and GIS data could be used to generate natural capital valuations, complemented by computer-assisted mass appraisal (CAMA).

The pilot brought to fore the tool's limitations and the ways it can be improved. For instance, more work is needed before a CAMA approach can be developed for determining natural and social capital, which encompasses communities' social dynamic, relationships within community structure and members' livelihood and land-use decisions. Where CAMA is determined as feasible, additional attention must be paid to how the information is be used, sensitivity to cultural norms, and laws around privacy in that region.

The report offers several lessons from the pilot findings, summarized below:

1. The universally recognized principle of free, prior, and informed consent, and equitable representation and participation across villages using the land parcel in question must be used to ensure local stakeholder buy-in before valuing the parcel.
2. Rough valuation estimates can be improved by using creative, locally appropriate survey methods, especially in rapid, community-deliberated settings.
3. Any realistic assumption about opportunity costs must factor in treatment of labor costs, even if community members or local households using the land parcel are not being paid for their time.
4. Any user-reported data must be validated to adjust for errors. The tool is best used in areas where communities, local NGOs, or others have the capacity to validate their findings using past data, or to help improve record-keeping going forward.
5. While an income-based approach can represent the value currently derived by users from a land parcel, it does not represent a parcel's full potential (e.g. if land use changes to higher-value crops).

The pilot also provided some interesting insights for the tool's use across ecosystems, given that its targeted commons captured a diversity of closed versus open commons used for a mix of forest and pastoral activities, across grassland and forest ecosystems. For instance, a closed forestland ecosystem proved to be far more complex than others in its greater diversity of direct products available for local consumption and sale, compared to other commons that were mainly used for fodder and fuelwood.

There appears to be diverse potential to scale up use of the tool. Potential uses include providing comparisons of value before and after land use management, and decision-making support to explore different future scenarios based on varying natural resource management and investment decisions. While currently limited to inland natural resources, the tool could be synced to value both rural and urban lands across diverse settings, which would require additional field testing. It could also help facilitate intra-community negotiations over land use and related benefits.

Herding sheep, India. Photo by the Foundation for Ecological Security.

Finally, while India is a strong setting for a pilot, given its significant share of ongoing rural land conflicts and complex land tenure situation, the purpose of this exercise is to ultimately adapt the tool for use in a variety of countries. For this, a cross-pollination of ideas is needed. This report discusses the role of GIS, remote sensing, and CAMA in a future scale-up scenario. While all have the potential to become integral elements of rural land valuation, more work is needed if an income-based, bottom-up approach is to become truly compatible with indicators for biophysical productive capacity.

Overall, the learnings from piloting in Rajasthan offer an optimistic outlook for its use going forward. Our proposed approach must not be considered an end-all solution, but rather an invitation for further dialogue and exchange of ideas on how best to improve the Rural Valuation Tool and its ability to thoroughly capture the value of rural land and its assets.

Chapter 1

Introduction

Landscape in Bhilwara District, Rajasthan, India. Photo by the Foundation for Ecological Security.

Millions of people live in the world's rural areas and rely on natural resources for their livelihoods. While land provides individuals and communities with income, shelter, and food as well as intangible services, there is often little understanding of the economic value associated with these provisions.[1] The dearth of information on rural assets often leaves individuals and communities vulnerable to speculation and missed opportunities to benefit from their natural capital. When faced with outside interest in their lands or resources, rural residents may find themselves ill-equipped to defend their claims to continue using the land, or negotiate fair compensation.

In recent years, land disputes between local communities and large-scale investors in developing countries have drawn considerable public attention. The Rights and Resources Initiative and the Tata Institute of Social Sciences tracked 289 ongoing land conflicts in India between January and September 2016 alone, estimated to capture only 25 to 40% of the actual number of such conflicts in the country.[2] Three quarters of these land-related conflicts involved common lands. Over 40 percent of all land-related conflicts involved forest lands, the majority of which occurred in regions where the state had failed to recognize the customary rights of tribal communities.

Land disputes often emerge from misunderstandings and power struggles between governments, industry, and communities, as well as within communities themselves. From the perspective of governments and private sector, land is often seen as a source of revenue. They may see opposition from communities as violating statutory rights in situations where community land tenure is weak or unclear to begin with. At the same time, companies and governments incur risks by underestimating the value of community assets.[3] Particularly within rural contexts, land prices are often hard to determine and may fail to capture the true value of land. This is increasingly a concern as the area of land and natural resources under commercial investment continues to grow.[4]

THE RURAL VALUATION TOOL

In response to these conditions, Indufor, in collaboration with the Foundation for Ecological Security (FES) and Ulster University, developed an innovative approach to evaluating land with support from Omidyar Network. This bottom-up land valuation tool can be used by individuals, communities, NGOs, or cooperatives to measure the value that people derive from a specific land parcel, and measure the level of tenure security over that land parcel. The tool is especially suited for valuing land that does not yet have a clear market value, is extralegal in tenure status, and/or holds many nonmarket assets. Equipping rural residents, the investment community, and governments with a tool to ascertain economic values across a broad range of natural assets held and used by rural residents can help reduce ambiguity, and empower residents to negotiate from a stronger position – ultimately reducing conflicts and improving investment outcomes. The tool aims to:

- Illustrate a benchmark of the wide range of benefits (in monetary terms) that individuals and communities derive from their land. This could be used as an advocacy tool, for example for greater devolution of rights to communities either through leasehold arrangements or additional reforms.
- Empower rural residents with access to information and create incentives to improve stewardship.
- Help communicate the winners and losers associated with different land use scenarios (i.e. different levels of tenure security, social capital, and natural capital conservation).
- Place an estimated value on the costs that would result from restoring the benefits and services derived from common resources if access to such lands were to be extinguished.
- Help understand the relationships among rural residents and facilitate intra-community negotiations over land use and related benefits.

Unlike traditional valuation approaches, the Rural Valuation Tool does not try to place a market value on land based on conventional real estate indicators or government valuation schedules. Instead, it captures a more diverse set of indicators to estimate the actual value that rural residents derive from their lands. The tool generates the value from the user's perspective.

Using historical data collected through focal group meetings with communities, the RVT populates a discounted cash flow (DCF) model that performs a cost-benefit analysis to calculate net benefits derived from natural capital projected over a 15-year period. The discount rate is informed by the level of social capital and tenure security related to the land parcel in question, as well as country-specific investment risk. The DCF currently covers tangible values derived from

Using the tool

A field manual is available with guidance on using the tool in the field. Data for the tool can be collected using paper surveys or RVT. RVT is a free, Android-based app available to download on the Indufor website and Github along with a user guide at http://bit.ly/2w4dAXu. An Excel version of the tool is also available.

harvesting of forest products, agriculture, grazing, mining, and water use as well as intangible services such as spiritual or recreational value.[5]

Initial piloting of the tool has resulted in valuations of six commons used by six villages in Rajasthan working with FES, which has decades of experience operating throughout rural India.

The following chapters provide an overview of relevant valuation methods (Chapter 2), a description of the developed Rural Valuation Tool (Chapter 3), and learnings from piloting the tool in Rajasthan (Chapter 4). A discussion of the role of GIS, remote sensing, and computer-assisted mass appraisal in scaling up use of the tool can be found at the end (Annex 1).

Chapter 2

Land Valuation Primer

FES staff discuss landscape with village chief in Kyara ka Khet, Udaipur District, Rajasthan, India. Photo by Indufor North America.

For rural residents, land is an aggregation of natural capital that provides them with tangible benefits such as income, shelter, food, and energy as well as intangible benefits such as spiritual or recreational value. Some level of social capital is associated with individual or community capacity to steward that land sustainably, based on a combination of tenure security, institutional capacity, and community cohesion. Identifying land used by communities that is often managed for decades as a long-term asset (i.e. used for more than 12 months as defined under the International Financial Reporting Standards[6]) can help provide incentives for sustainable land management and strengthen land tenure security.

Ideally, this broader set of natural and social capital can be incorporated into land valuation beyond the scope of traditional land valuation methods, and fully measure the extent of benefits rural residents can derive from the land. Major challenges to do so include:

- Limited land market information in rural areas
- Frequent disconnect between de facto land use and legal land use classification
- Land tenure insecurity, frequent conflict between land occupants and rights holder
- Difficulty to quantify intangible benefits

TRADITIONAL LAND VALUATION APPROACHES

Where markets are relatively active in transacting ownership and use rights in land, a number of mainstream valuation methods can be used to estimate value based on market signals. Conventional market-based methods include:

- *Comparable sales approach:* Uses land sales data as a benchmark for the land being valued, ideally based upon analysis of all relevant recent transactions in the vicinity. It adjusts comparable variables to reflect the characteristics of the target land parcel. Despite some standardized scientific guidance, this method relies considerably on intuition drawn from the appraiser's skills and experience. It works best in mature markets, where good market and comparable transactions data are available.
- *Profit approach:* Ideally suited to the valuation of commercial land or buildings that have active business activities, but where data on comparable sales or rental transactions are not available. Based on an assessment of receipts and expenditures of the business, the method can establish its fair maintainable trade, which allows the identification of net profit capitalized to identify value.
- *Income approach*: Based on an assessment of net income over a given time period. The approach can adopt a traditional income capitalization approach or a contemporary discounted cash flow approach, utilizing a discount rate linked to a combination of risks taken and alternative investment opportunity rates. The approach relies heavily on the ability to assess net income/cash flows, which are highly sensitive to the discount rate.
- *Replacement cost approach:* Approximates value by estimating the cost of providing an alternative, with some deductions made based on issues of age or function, where the structure being assessed is not new or perfectly functioning. This depreciated replacement cost is then

Landscape in Bhilwara District, Rajasthan, India. Photo by the Foundation for Ecological Security.

Table 1. Examples of natural capital valuation approaches

Natural Capital Type	Valuation Methods
Ecosystem services	Instrumental values: income approach or avoided cost approach Intrinsic values: contingent valuation
Carbon sequestration	Carbon sequestration assessment, income approach using carbon market price data as benchmarks
Watershed services	Income approach using established payment-for-watershed-services rates as benchmarks Economics modeling with empirical data of soil erosion effects
Biodiversity services	Instrumental values: income approach using mitigation banking, species banking, or other biodiversity offset prices as benchmarks; avoided cost approach Intrinsic values: contingent valuation
Recreational and spiritual value	Income approach using recreational or entrance fees as benchmarks Travel cost method, contingent valuation, hedonic pricing

added to the land value in its current use and an additional sum to represent the time and risk involved in providing the alternative asset. This method is mainly used to value buildings or other improvements to land where other methods are applicable.

WHAT IS NATURAL CAPITAL?

Although definitions vary, natural capital is commonly thought to encompass the aggregate assets or stocks[7] that provide both natural resources and environmental services.[8] A growing consensus in the recognition of natural capital reflects a shift from only focusing on tradable natural resources to a broader concept of environmental services. Freeman outlines five major services produced by a "natural resource-environmental complex:"[9]

- *Raw material inputs*: support livelihoods and the economy, e.g. fossil fuels, wood products, minerals, water, and fish.
- *Life support services*: support humans and wildlife in the form of a breathable atmosphere, clean water, and a livable climate.
- *Amenity services*: provide opportunities for recreation, wildlife observation, and scenic views.
- *Waste receptor services*: include dispersal, transformation, and storage of residuals generated as by-products of economic activity.
- *System stability and resilience services*: protect human activities against natural disasters and other sources of disruption.

HOW IS NATURAL CAPITAL VALUED?

Natural capital comes in diverse forms. Tangible forms (e.g. goods such as non-timber forest products) can be valued via income capitalization and stated-preference approaches. Intangible forms (e.g. services such as erosion control or wastewater treatment) call for different approaches, ranging from income capitalization (in the case of payments for ecosystem services or ecotourism for recreational values) to indirect market valuation approaches such as avoided cost, travel cost, hedonic pricing, and contingent valuation.[10] Examples of some valuation approaches for intangible natural capital are shown in Table 1.

WHAT IS SOCIAL CAPITAL?

Social capital is a multi-faceted concept relevant across land, resource, governance, and development fields. Although social capital eludes a single standard definition, the concept encompasses notions of trust, connectedness, social cohesion, and community involvement. Social capital is found to play a key role in the maintenance of natural resources that rural residents rely on for their livelihoods, particularly common-pool natural resources.

As an extension, some scholars argue that social capital is linked to the type and security of tenure rights over land and resources, and the decisions governing such resources.[11] Given this, stronger social capital in a community is said to underpin more sustainable resource use and management of collective resources. This becomes important in cases where legal property rights are unclear, or not vested to the community using the resource. In that case, a community's measure of social capital may serve as a reasonable proxy to indicate its perceived tenure security over a particular land parcel.[12]

HOW IS SOCIAL CAPITAL VALUED?

Research shows that efforts to measure social capital are diverse, typically aiming to measure its one or more facets. This is often done through a combination of ordinal rating or ranking scales, as well as numeric data on information such as number of civil society groups, extent of participation in such groups, and/or the amount of time that community members spend in civic activities. Different quantitative indicators to represent the extent of community connectedness and participation in civil society are also widely used, as are various ratings of respondent trust across different groups and community actors. Levels of agreement with statements indicating more connected, cohesive, trusted and reciprocal interactions within the community are also used.

There is thus a wide array of tools and survey instruments aimed at measuring different facets of social capital available to draw on when developing a question bank to indicate the capital's extent. When using a rapid assessment approach, one needs to ensure that the questions and tool structure fit within the envisioned implementation parameters, and provide the desired level of information across different kinds of tenure regimes and natural resources present in a community.

Efforts to attach a discrete value to social capital are uncommon, and attempts to place a specific monetary value on social capital appear to be very rare. This is not surprising, given that social capital is an intangible, non-market good, which tends to be particularly challenging to value in economic terms. Hedonic pricing has also been very infrequently used to monetize social capital. A benefit of this method is that it can be derived from group-level information. However, the method also relies strongly on income and price information for market-based goods, such as house values, which do not readily lend themselves to emerging-market contexts.

VALUATION-FRIENDLY TECHNOLOGIES

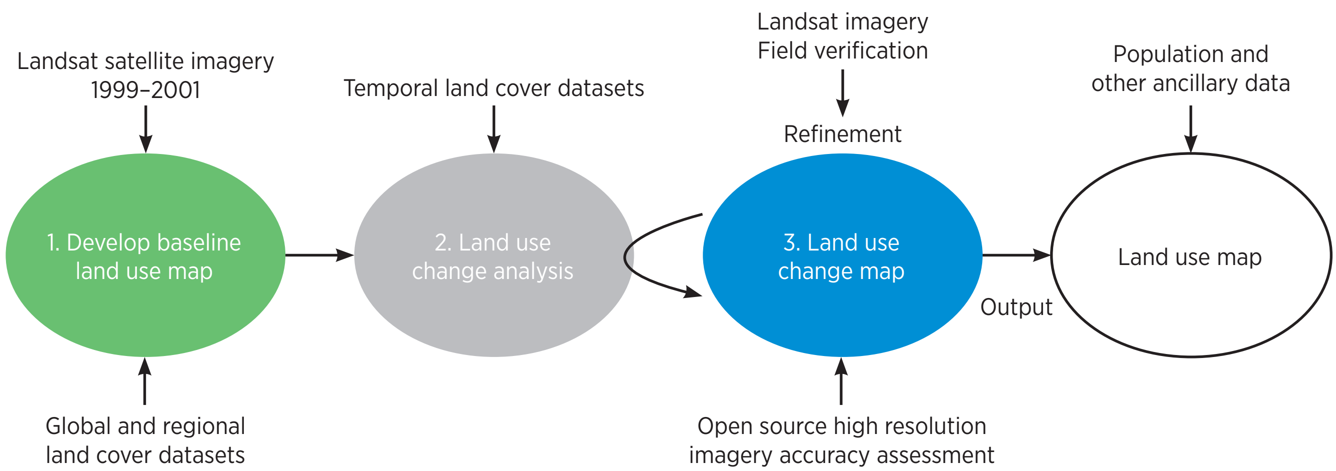
In mature real estate markets, land is valued using comparable sales or market value. This can draw upon the application of modern technologies in valuation, such as computer-assisted mass appraisal and remote sensing.

What Is CAMA?

Computer-assisted mass appraisal (CAMA) has the power to infer the value of many properties based on an existing database of appraisals. CAMA works by analyzing the statistical significance to the sale price of a small number of attributes that typically influence value. In the real estate world, these attributes include floor/plot area, habitable rooms, construction method, level of detachment, and certain neighborhood characteristics like the presence of local services, distance to a main road, and distance to a Central Business District. Releasing this information provides greater market transparency, which is crucial in informing decision-making by land owners, occupants, and potential buyers.

In liquid markets for real estate and land, CAMA is typically used to value residential property for annual property taxation purposes. While CAMA is arguably more common in the property tax and municipal assessment arenas, the concept and its use are widespread, for example in the private sector where it is referred to as automated valuation modeling.[13] Property valuation can

Figure 1. Example Remote Sensing Process and Flow



be challenging however, as only a small percentage of property transacts in a relevant time period (e.g. 18–24 months) meaning that 100% of properties need to be valued with as little as 5% having sold during that period. Valuing each property manually and individually would prove prohibitively expensive.

Remote Sensing

Remote sensing is a technique used to derive information about the physical, chemical, and biological properties of objects without direct physical contact. Information is derived from measurements of the amount of electromagnetic radiation reflected, emitted, or scattered from objects. Markets with relatively sparse sales information and property characteristics can be potentially problematic when attempting to derive accurate and reliable valuations. Remote sensing offers the ability to locate data (e.g. building identification, size, topography) using oblique imagery or other aerial viewing services, whether from a satellite or static flyover. LIDAR (light detection and ranging) is another aerial service that uses lasers to detect physical characteristics (e.g. tree height). Some are readily available and cheap (even free), while others may be expensive.

To use remote sensing to inform land valuation, a number of key variables are identified that can be assessed and monitored using remote sensed data to for valuation in forestry and agriculture. Figure 1 shows a basic schematic of how the different approaches and components could be integrated.

EXISTING COMMUNITY VALUATION TOOLS

Initiatives promoting the integration of natural capital into national wealth are an attempt to place monetary value on an economy's natural resources.[14] Yet they generally focus their attention at the macro-level, overlooking the values provided to households and communities. The nascent field of social capital accounting is also likely to provide more information on the value generated through social networks, but to date a link has not been made between strong social capital and natural capital in valuation accounting.[15]

To put theory into practice, land valuation needs to be affordable and replicable if it is to be used by and for communities. Tradeoffs between cost and accuracy must be considered when selecting a valuation approach that can capture both social and natural capital. Table 2 at the end of the chapter provides a comparative assessment conducted by Bagstad et al. (2013) of various existing decision-support tools, ranging from simple spreadsheet models to complex software packages, for valuing ecosystem services.[16] Their evaluation criteria include (1) quantification and uncertainty; (2) time requirements; (3) capacity for independent application; (4) level of development and documentation; (5) scalability; (6) generalizability; (7) nonmonetary and cultural perspectives; and (8) affordability.

Among the 17 tools in the table, some may be used together. For instance, ESR or Co$ting Nature could serve as preliminary screening tools to evaluate ecosystem services of interest, and create a broad framework to conduct more rigorous analyses from mapping and modelling tools. These tools quantify landscape-level ecosystem services tradeoffs using biophysical models (e.g. ARIES, EcoAIM, Envision, EPM, InVEST, InFOREST, LUCI, MIMES) and surveys to capture social values (SolVES).

Namati's two-hour Community Land and Natural Resource Valuation Activity helps communities better understand replacement costs of their common lands and natural resources.[17] This confidence- and trust-building preparatory exercise is intended to provide a quick grasp of the inherent value of common land to a community. However, some challenges in data collection and analysis with Namati's tool include:

- Using a single replacement-cost valuation to accurately calculate the value of a combination of resources generated/used across diverse contexts, e.g. for household consumption or for sale, gathered from private or communally managed land
- Calculating the value of "lost" cash crop income, which involves factoring complex input costs, labor, opportunity costs, and transportation costs
- Incorporating resources that are harvested or used in irregular cycles or frequency
- Ensuring consistency in units of measurement and price data
- Accounting for ecosystem services and intangible spiritual or recreational resources, currently not within the scope of the tool

COMMON CHALLENGES WITH EXISTING APPROACHES

Traditional valuation approaches are grounded in a market approach to valuation and are closely allied to practices of financial accounting, based on benefit-cost analysis. Such valuation methods for commercial use of land and forests often do not consider intangible benefits important to community livelihoods.[18] In summary, they may neglect to address several problems:

Overlooking natural and social capital: Natural and social capital are frequently ignored in conventional valuation approaches. This is changing, as companies are beginning to use an increasingly diverse range of environmental and social metrics to help inform strategic, management, and operational decisions. Valuation of natural and social capital helps organizations understand their impacts and dependencies, either in terms of financial value to companies and shareholders or social and environmental values to local and other stakeholders. The finance community increasingly recognizes the commercial value of broadening information available to inform decision-making, to ensure all relevant factors and risks are taken into account.

Underestimating cross-media environmental effects: Valuation often focuses on discrete ecosystem services and fails to account for interaction effects, for example those between land, water, and air.

Lack of accounting for regulatory services and linkages between land parcels: The management of one land parcel may influence the productivity of nearby lands. For example, management of an upstream area could impact the health of croplands downstream. The positive or negative externalities in terms of crop land valuation may not be directly priced into the value of the upstream parcel. Land parcels may also be a source of pollinators and other forms of biodiversity that benefit croplands. These regulatory services are not directly priced or captured in normal valuation approaches, often due to risks of double-counting the value of regulatory services that might be embedded in products

Limitations in reporting approaches: The financial performance of a company is judged by both its income statement and balance sheet. However, jurisdictions typically only compile income statements (GDP, i.e. the sum of income flows from natural resources) and pay little attention to the balance sheet (natural capital, i.e. the sum of income flows from various services provided by the entire ecosystem).

Need to measure flows rather than stocks: Valuation may be done in terms of natural capital stocks or flows. Godoy[19] distinguished these two types. The first indicates the quantity (e.g. of standing timber) in the forest, while flow records the quantity extracted or used. The value of the stock is meaningless if not related to present or sustainable use. In addition, the difference between stock and flow can be large.

Misalignment of market value and economic value: Many policymakers argue that tropical forests have no economic value unless they are logged or farmed, which confuses economic value with market value (i.e. replacement cost). Everything can have economic value as long as it benefits humans, but only tradable goods have market value. Conventional economic value measures individual utility maximization over a discrete period. However, if it is to be sustained over time through sustainable management, economic value should be assessed by contributions (in all periods) to achieve individual utility, and include other factors such as social capital.[20]

Inability to estimate spiritual value using a direct market-based approach: Traditional valuation methods would ascribe a low value to land that can neither be worked nor sold. Nevertheless, the sites could be seen as priceless by users if it has spiritual value, creating a valuation conundrum that seeks to derive a useful value between zero (market value) and priceless (community assessment). In the face of such use and disposal restrictions, market value approaches just cannot operate effectively. There is a need to resort to other methods to assess the extent to which society places value on such land and to express it in monetary terms to facilitate meaningful decision making. Alternative options include contingent valuation approaches (where users are asked to estimate their willingness to pay for continued access and use) and cost-benefit analysis (which suffers some similar flaws as it uses market approaches to assess value, and is complex to implement).

Difficulty of assigning monetary value to nonmarket goods: It is difficult to assign a monetary value to nonmarket goods. For example, communally managed land often has no direct market sale or rent value, as communities do not have the statutory right to sell or lease the land in most cases – even when they have customary rights to access and use the land. Although informal markets may exist for tenure rights such as community shares and grazing rights, there are often no transferable titles or transparent market evidence to support this. Godoy outlines several methods that attempt to approximate a fair value for nonmarket goods:[21]

- Draw upon the market value of other goods used to barter for the good in question
- Use a close, priced substitute, requiring some price adjustment between the priced and nonpriced products comparing their characteristics
- Calculate expenditures of labor or energy required to produce one unit of product
- Consider trade-off ratios to obtain a range of willingness to accept (WTA) and willingness to pay (WTP)

Difficulty of determining the discount rate: Parcel-level risks are not systematically incorporated into the discount rate. Sometimes they are factored in directly into cash flows. Potential risks to factor in include natural environmental risks, such as climate or water risk. Anthropocentric risks could also be factored in, accounting for the level of risk in how natural resources are being extracted sustainably or overexploited, including a depletion risk premium.[22] Other risks that may have a substantial impact on natural resource management, like tenure-related risks, can also be considered.

Need to use appropriate units: Communities in rural areas might not use standard units to quantify the amount of a particular good or service being used. This creates challenges when quantifying the flow of goods/services, and eventually their value.

A WAY FORWARD

In the process of developing the tool, Indufor completed a literature review and consulted with professionals from civil society, government, valuation and remote sensing communities, and representatives in Rajasthan, India where the tool was piloted. Some key gaps identified from this process include:

- There is a clear gap for a valuation-focused tool for emerging markets that balances rigor with efficiency and integrates market and non-market methods.
- Existing tools to value ecosystems overlook tenure rights and are cumbersome to implement, requiring a high level of time commitment and technical expertise.
- Most existing tools take an ecosystem perspective rather than a community-focused unit of analysis, often failing to integrate social capital.
- Existing valuation approaches fall short in both bottom-up approaches to valuing natural capital and top-down regressions of market data in rural areas
- Ongoing initiatives with similar goals exist, but are not yet advanced or have limited scalability.

Opportunities identified include:

- There exists a solid empirical basis for incorporating social capital into natural capital accounting.
- A new tool could enhance thinking on how compensation approaches can be improved to more robustly measures for forecasting the values communities derive from their lands, including communally managed resources.
- Advances in technology, particularly remote sensing and automated learning, offer opportunities to rapidly decrease the time required to identify property characteristics

Indufor's rural land valuation tool was developed in response to these findings, and is detailed in the following chapter.

Table 2. Comparison of existing tools

Tool	Quantifiable, approach to uncertainty	Time requirements	Capacity for independent application	Level of development & documentation	Scalability	Generalizability	Nonmonetary & cultural perspectives	Affordability, insights, integration with existing environmental assessment
ESR	Qualitative	Low, depending on stakeholder involvement in the survey process	Yes	Fully developed and documented	Multiple scales	High	No valuation component	Most useful as a low-cost screening tool
InVEST	Quantitative, uncertainty due to varying inputs	Moderate to high, depending on data availability to support modeling	Yes	"Tier 1" models fully developed and documented; "Tier 2" documented but not yet released	Watershed or landscape scale	High, though limited by availability of underlying data	Biophysical values, can be monetized	Spatially explicit ecosystem service tradeoff maps; currently relatively time consuming to parameterize
ARIES	Quantitative, uncertainty through Bayesian networks and Monte Carlo simulation	High to develop new case studies, low for preexisting case studies	Yes, through web explorer or stand-alone software tool	Fully documented; case studies complete but global models and web tool under development	Watershed or landscape scale	Low until global models are completed	Biophysical values, can be monetized	Spatially explicit ecosystem service tradeoff, flow, and uncertainty maps; currently time consuming for new applications
LUCI	Quantitative, currently does not report uncertainty	Moderate; tool is designed for simplicity and transparency, ideally with stakeholder engagement	Yes, through website is under development and more detailed user guidance is presumably forthcoming	Initial documentation and case study complete; follow-up case studies in development	Site to watershed or landscape scale	Relatively high; a stakeholder engagement process is intended to aid in "localizing" the data and models	Currently illustrates tradeoffs between services but does not include valuation	Spatially explicit ecosystem service tradeoff maps; designed to be relatively intuitive to use and interpret
MIMES	Quantitative, uncertainty through varying inputs (automated)	High to develop and apply new case studies	Yes, assuming user has access to SIMILE modeling software	Some models complete but not documented	Multiple scales	Low until global or national models are completed	Monetary valuation via input-output analysis	Dynamic modeling and valuation using input-output analysis; currently time consuming to develop and run

Table 2. Comparison of existing tools (*continued*)

Tool	Quantifiable, approach to uncertainty	Time requirements	Capacity for independent application	Level of development & documentation	Scalability	Generalizability	Nonmonetary & cultural perspectives	Affordability, insights, integration with existing environmental assessment
EcoServ	Quantitative, uncertainty through varying inputs	High to develop new case studies, low for existing case studies	Yes, pending release of web explorer	Under development, not yet documented	Site to landscape scale	Low until global or national models are completed	Biophysical values, can be monetized	In development, will offer spatially explicit maps of ecosystem service tradeoffs
Co$ting Nature	Quantitative	Low	Yes	Partially documented	Landscape scale	High	Outputs indexed, bundled ecosystem service values	Rapid analysis of indexed, bundled services based on global data, along with conservation
SolVES	Quantitative, no explicit handling of uncertainty	High if primary surveys are required, low if function transfer approach is used	Yes, assuming user has access to ArcGIS	Fully developed and documented	Watershed or landscape scale	Low until value transfer can be shown to successfully estimate values at new sites	Nonmonetary preferences (rankings) of relative values for stakeholders	Provide maps of social values for ecosystem services; time consuming for new studies but lower-cost for value transfer
Envision	Quantitative	High to develop new case studies	Yes	Developed and documented for Pacific Northwest case study sites	Landscape scale	Place-specific	Allows nonmonetary tradeoff comparison, also supports monetary valuation	Cost-effective in regions where developed; time consuming for new applications
EPM	Quantitative	High to develop new case studies, low for existing case studies	Yes, through web browser	Developed and documented for three case study sites	Watershed or landscape scale	Place-specific	Ecological, economic, and quality of life attributes could support nonmonetary valuation	Cost-effective in regions where developed; time consuming for new applications
InFOREST	Quantitative	Low, accessed through online interface	Yes, through web browser	Developed and documented only for Virginia	Site to landscape scale	Currently place-specific	Designed as a credit calculator, no economic valuation	Cost-effective in regions where developed; time consuming for new applications

EcoAIM	Quantitative	Relatively low for basic mapping, greater for nonmonetary valuation	No	Public documentation unavailable	Watershed or landscape scale	High	Incorporates stakeholder preferences via modified risk analysis approach	Spatially explicit ecosystem service tradeoff maps; relatively time consuming to run
ESValue	Quantitative, uncertainty through Monte Carlo simulation	Relatively high to support consultant stakeholder valuation process	No	Public documentation unavailable	Watershed or landscape scale	High	Nonmonetary preferences via ranked analysis of tradeoffs by stakeholders	Stakeholder-based relative ecosystem service value assessment; relatively time consuming
EcoMetrix	Quantitative	Relatively low to support field visits and data analysis	No	Public documentation unavailable	Site scale	High, where ecological production functions are available	Designed as a credit calculator, no economic valuation	One method for site-scale ecosystem services assessment
NAIS	Quantitative, reports range of values	Variable depending on stakeholder involvement in developing the study	No	Developed but public documentation unavailable	Watershed or landscape scale	High, within limits of point transfer	Dollar values only	Point transfer for "ballpark numbers," building awareness of values
Ecosystem Valuation Toolkit	Quantitative, reports range of values	Assumed to be relatively low	Yes	Under development	Watershed or landscape scale	High, within limits of point transfer	Dollar values only	Point transfer for "ballpark numbers," building awareness of values
Benefit Transfer and Use Estimating Model Toolkit	Quantitative, uncertainty through varying inputs	Low	Yes	Fully developed and documented	Site to landscape scale	High	Dollar values only	Low cost approach to monetary valuation

Source: Bagstad, K.J., Semmens, D.J., Waage, S., Winthrop, R. (2013). A comparative assessment of decision-support tools for ecosystem services quantification and valuation. Ecosystem Services 5 (2013): e27-e39.

Chapter 3

Rural Valuation Tool

Community gathering in Udaipur District, Rajasthan, India. Photo by Gabriel Diamond.

Efforts to develop valuation tools for ecosystem services have reached a fair amount of consensus on key criteria for the tool's design, as detailed in the previous chapter. With these guiding principles and gaps in existing valuation methods in mind, Indufor set out to develop a rural land valuation tool for emerging markets that not only integrates market and nonmarket methods to produce primarily quantitative data, but also captures social as well as natural capital in diverse settings, balancing rigor with efficiency. Indufor has developed an Excel version of the valuation tool as well as an Android-compatible mobile application for easier use in the field (available at http://bit.ly/2w4dAXu).

The tool requires strong community participation, with guided facilitation by NGO or agency staff who have experience with community entry and qualitative data collection relating to land, resource, and community governance. It is implementable over two days of meetings per community, and is designed to yield a valuation that can be disaggregated by different natural resources and activities, as well as assess tenure security or statutory use rights than may vary across these resources.

The logistical constraints imposed by this design necessitate some tradeoffs, such as the level of detail that can be obtained and the accuracy of valuation figures. However, this initial proposed tool should be viewed as a prototype to be further refined and potentially expanded. For now, it can be used to produce valuations that indicate the general magnitude of net benefits a community derives from a land parcel. Validation using more technical assessments is needed for at least initial benchmarking to ensure that community-based results are within a reasonable margin of error.

OVERALL VALUATION FRAMEWORK

The Rural Valuation Tool uses a DCF method[23] to estimate the value of a land parcel with defined boundaries. Based on historical data and community survey information, the model projects the trends of key variables to simulate future cash flows (in *n* years), and incorporates a sovereign risk premium and social capital premium into the discount rate (*r*). The corresponding equation is:

$$DCF = \sum_{i=0}^{n} \frac{CF_i}{(1+r)^i}$$

CF = cash flow
r = discount rate
n = number of years

The tool supports natural capital accounting in rural environments, and by default accommodates the tangible benefits and costs associated with harvesting of forest products, grazing, agriculture, mining, and use of water from water bodies. It can also be used to value intangible benefits and costs such as recreation/spiritual value. In the latter case, intangibles are generally still valued based on a direct use-value approach,[24] for more conservative and easier accounting, as well as relative comparability across parcels.

SOCIAL CAPITAL

The concept of social capital broadly encompasses notions of trust, connectedness, social cohesion, and community involvement. Empirical evidence shows that social capital plays a key role in the long-term maintenance of natural resources that communities rely on for livelihoods.[25] Communally-managed parcels where tenure rights are strong and community management institutions are well-functioning tend to have a better maintained resource base in the long run. In order to assess the impact of higher or lower levels of social capital on land value, Indufor integrated a social capital score into the discount rate.

Drawing from its literature review, Indufor developed a qualitative assessment tool for evaluating social capital. Indufor initially piloted a 10-page social capital survey, but found it inefficient for community focus group discussions. We then revised the survey to a shorter version with a set of 14 questions focusing on core objective indicators, measuring the level of land tenure security, community cohesion, and resource governance capacity. Together, these questions reveal a community's ability to sustainably manage and benefit from natural resources on a specific parcel.

For private sector investments, credit ratings are made to establish creditworthiness on a debtor's ability to pay back debt by making timely interest payments, and the likelihood of default. Credit ratings affect the interest rate at which a company can borrow money, and the expected returns of a security, with higher ratings leading to lower interest rates.[26] [27] [28] Similarly, the level of social capital security influences the risk or creditworthiness of deriving future benefits from the land for local communities. With inspiration from credit rating approaches, Indufor developed a social capital ratings approach to translating the qualitative results of social capital survey into a rating that can feed into the discount rate portion of the DCF model.

The social capital quantification approach is similar to Moody's corporate risk assessment methods.[29] Moody's ratings are forward-looking, reflect expectations of future financial and operating performance, and enable informed peer comparison of companies. The major factors used by Moody's for building qualitative risk indicators have been adapted in our approach to include:

- Level of risk taken by land owner, occupants, and investors, combining sovereign and parcel-level risk
- Level of land tenure security
- Level of community capacity and experiences in managing the parcel

Table 3. Weights for Social Capital Survey Questions

Question Scope	Weight
Breadth of rights	20%
Legality of rights	20%
Security of land rights	15%
Institutions and rules	15%
Inclusivity and fairness	15%
Robustness of institutions	15%
Total	100%

Table 4. Scores for Social Capital Survey Answers

Answer	Score
A	20
B	15
C	10
D	5
E	0

Indufor developed a questionnaire regarding the above factors, assigning different weights (Table 3) and scores for each question and answer (Table 4). The results of the questionnaire produce a weighted-sum social capital score of 0-20 (20 being the highest score corresponding to highest social capital) that allows for comparison of social capital across land parcels.

The highest weight (a total of 55%) is given to land tenure security for its critical role in enabling sustainable land management. Land tenure is sometimes used interchangeably with property rights. Property rights are more inclusive, with property broadly ranging from land and real estate to movable assets, or even intangibles like patents and ideas. Land tenure on the other hand is defined as the relationship that people, groups, or entities have with land and land-based resources.[30] This relationship is defined by rules that guide how land is allocated, used, managed, and transferred. Rules related to land tenure, either customary or statutory, can create powerful incentives for land and resources management. Positive incentives provided by secure land tenure could provide the foundation for a sustainable development plan with a long-term horizon. Communities tend to be more willing to conserve resources and invest in improving land if their tenure rights are secure and recognized. On the contrary, without secured and recognized tenure, people might be more likely to overuse land.

The social capital scores correspond to 20 different notches, each of which corresponds to an alphanumeric rating (Aaa - Ca) according to Moody's criteria (Table 5).[31] The rating in turn links to an estimated discount rate spread (0%-12%) based on current market interest rates.[32] The discount rate for a DCF model would be determined by the following equation:

Discount Rate = Risk Free Rate + Sovereign Risk Premium + Social Capital Risk Premium = Sovereign Risk Rate + Social Capital Risk Premium

Table 5. Links between Social Capital Score and Premium Applied to Discount Rate

Score		Premium	
More than	Less than	Rating	Spread
0.0	0.5	Ca	12.0%
0.5	1.5	Caa3	10.0%
1.5	2.5	Caa2	9.0%
2.5	3.5	Caa1	7.5%
3.5	4.5	B3	6.5%
4.5	5.5	B2	5.5%
5.5	6.5	B1	4.5%
6.5	7.5	Ba3	3.6%
7.5	8.5	Ba2	3.0%
8.5	9.5	Ba1	2.5%
9.5	10.5	Baa3	2.2%
10.5	11.5	Baa2	1.9%
11.5	12.5	Baa1	1.6%
12.5	13.5	A3	1.2%
13.5	14.5	A2	0.9%
14.5	15.5	A1	0.7%
15.5	16.5	Aa3	0.6%
16.5	17.5	Aa2	0.5%
17.5	18.5	Aa1	0.4%
18.5	20.0	Aaa	0.0%

Sovereign risk rates are unique to each country and updated periodically. In practice, it is recommended to use the interest rate of the country's 10-year Treasury Bond as a proxy for the sovereign risk rate. Parcels that score a 20 are assigned the same discount rate as the sovereign risk rate, with social capital risk premiums added for each notch below 20.

NATURAL CAPITAL

Natural capital is commonly thought to encompass the aggregate assets or stocks that provide both natural resources (tangible) and environmental services (intangible).[33]

Tangibles

Tangible natural capital comes in a wide range of forms. Informed by literature review, Indufor built valuation models for agriculture, harvesting of timber and non-timber forest products, grazing, aquaculture production, fishery production, artisanal mining, housing/real estate, and vacant land. For each land use activity type, Indufor performed a cost-benefit analysis, and designed questions for collecting historical data and projecting future trends.

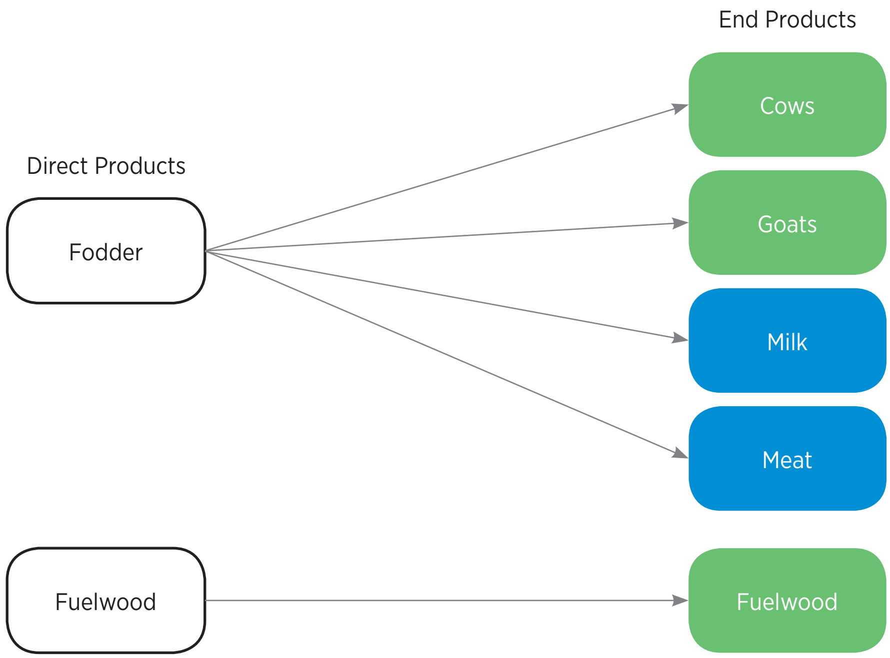
Following field testing in India, Indufor adjusted survey questions to be more applicable for data collection at the community level. The language of the questions was rephrased to acquire more specific information. Indufor also took other rural-contextual problems into consideration, such as data availability of community surveys, seeking proxies for market price in a non-market area, scientific conversion of local units, physical land types and legal land uses.

The refined tangible natural capital questionnaire focuses on five modes of tangible natural capital: 1) harvesting of forest products, 2) agriculture, 3) grazing, 4) mining, and 5) water use.

The approach to estimate annual cash flows ($CF_{x,i}$) for harvesting of forest products, agriculture, and mining is straightforward because products are directly consumed or sold by individuals or the community. Key variables include harvesting/extracting frequency ($f_{x,i}$), quantity harvested each time per household ($Q_{x,i}$), num-

Grasslands, India. Photo by the Foundation for Ecological Security.

Figure 2. Relationship between Direct Products and End Products



ber of households ($H_{x,i}$), and market price of the harvesting/extracting product ($P_{x,i}$). The annual cash flow for benefit x of year i equals:

$$CF_{x,i} = f_{x,i} \times Q_{x,i} \times H_{x,i} \times P_{x,i}$$

It is possible to value these flows of natural capital through the flow of net benefits from direct products because they are also end products. For instance, fuelwood gathered in forests can be directly used by households or sold on the market. Thus, fuelwood is both a direct product (acquired from the land) and an end product (consumed/sold). However, fodder is not an end product but rather an input for other products. In this case, the end products of fodder-based natural capital include livestock (e.g. goats, cattle) and their by-products (e.g. milk, meat, hide). Figure 2 explains the relationship between direct products and end products.

The avoided cost approach can be used to value flows of natural capital for which income data for direct products are not available. For example, fodder grazed or cut-and-carried off of a parcel of land provides benefits in the form of avoided costs, i.e. what people would have had to pay by buying an equivalent amount of fodder from the market. Annual avoided costs for fodder can be estimated based on estimates of the fodder from this parcel consumed by each livestock in a year. Key variables include number of months of a year grazing livestock on the parcel ($M_{x,i}$), total amount of fodder consumed per animal per year ($Q_{x,i}$), number of livestock ($N_{x,i}$), and market price of fodder ($P_{x,i}$). The annual flow of fodder benefits consumed by animal *x* of year *i* equals:

$$CF_{x,i} = \frac{M_{x,i}}{12} \times Q_{x,i} \times N_{x,i} \times P_{x,i}$$

Similarly, water acquired through the physical water body on this parcel can also provide avoided cost benefits. The amount of water use should be accounted for thoroughly by including both on-site water use and the amount of water extracted for use by individual households and public forums offsite. Examples of on-site water use may include drinking water for livestock, and water for laundry and bathing. Community-reported data on the amount of water use can be validated against measurements of the annual carrying capacity of the water body.

Tending goats, India. Photo by the Foundation for Ecological Security.

Historical data collected through community surveys is used for analyzing and understanding patterns and trends of generating benefits from the land. Based on the analysis, Indufor projects future cash flows of each benefit in the context of economic inflation and future community development plans. Fifteen years is set as the standard for projection years across all land use activities. This is a result of extending the period of shorter-term natural resource management regimes for agriculture, grazing, and mining to be standardized and matched with the period used for longer-term management regimes for timber and other forest products, which are based on longer harvest rotations

To quantify the benefits derived and put a monetary number on land value, it is necessary to introduce a market price for products. However, setting market prices can be difficult in rural areas, especially in areas with illiquid markets. Other public data for market prices are available. For instance, the minimum daily wage at state level could be used as a proxy for labor cost, and average market prices for clothes or shovels (products purchased on the market) can be used for calculating the market price of fodder or crops on a barter system basis. Currency and units used for data collection should be standardized during the land valuation process.

Intangibles

Spiritual and Recreational Value

A site with spiritual or recreational value can include significant built infrastructure and/or natural infrastructure. The natural capital approach discussed above can be used to value any direct products that can be derived from a parcel, for instance fuelwood and fodder from a sacred grove.

To value the more intangible spiritual or recreational value of a site requires a different approach. For that, the tool provides guidance inspired by the travel-cost method to estimate the aggregate opportunity costs and actual expenses incurred by people traveling to and using the site as a proxy for the spiritual or recreational value they derive from the site. Expenses such as donations may also be factored in as proxy indicators of how much people value the site. Costs incurred to maintain a site, for example to restore or enhance certain elements, can also indicate value. However, this valuation should be done carefully so as not to double count values, such as by counting donations made toward site maintenance.

Given the major costs to conduct traditional travel-cost studies, the guidance for the Rural Valuation Tool proposes a streamlined version relying on averages and community estimates. Averages could be derived by conducting a survey on the amount of time that people spend visiting for major events such as an annual festival, versus the time spent by regular visitors, and finally for irregular one-off tourism. Averages can also be derived for the distance that people travel from different regions and associated average travel expenses, e.g. gas or public transportation expenses. Average socioeconomic levels will also need to be derived as a crude measure of inferring the opportunity cost of people traveling from different regions. Ideally, the survey could be done in person at major events or indicative days, but short of that, data validation will be needed for community estimates based on recordkeeping for visitors and donations. This may be difficult in areas where there is no entrance fee nor formalized entry documentation (e.g. check-in process or book signing).

Calculations of the cost spent traveling and at the site should be discounted because people will be deriving benefits from the visit as well as the journey. The discount factor can be adjusted in a sensitivity analysis based on case-specific factors, e.g. if the travel route is more or less scenic, or if the trip is multipurpose.[34]

A key element to consider is that the number of hours spent at or traveling to a site may not necessarily correlate with the actual spiritual benefits obtained from the site. For instance, people may frequent a church every week of the year but potentially derive a much greater amount of spiritual value from visiting a unique temple once in their lifetime. Contingent valuation could be used to estimate the worth of such sites, but would require extreme care in phrasing. The phrasing could vary with the payment vehicle but may risk misinterpretation by people who may suspect that they will lose free access to the site, depending on the country and local settings. The travel-cost method would provide a cost-based approach as an indication of willingness to pay in actual and opportunity costs to maintain, access, and use a site. This would anchor the valuation of these sites based on concrete assumptions, which could understate the ‘priceless’ value of such sites but are more defensible than contingent valuation.

SYNCING THE TOOL WITH OTHER VALUATION METHODS FOR INTANGIBLE ASSETS

Some intangibles are less amenable to a rapid rural assessment approach using back-of-the-envelope estimates made by individuals or communities.

Carbon

The tool itself does not develop unique guidance on carbon accounting, but refers users to existing best practices. To account for the value of carbon sequestration, a community can use an income-based approach assuming some change in management or threat level that results in additional carbon benefits. This should be done with an NGO or project developer with carbon expertise.

It is recommended that users value carbon sequestration based on what is additional and monetizable through carbon finance. Some have valued carbon sequestration based on total forest stocks rather than figuring out a baseline against which to estimate carbon sequestration, which would not have occurred under business as usual. However, this may be misleading and overstate the actual marketable value of land. Carbon quantification methodologies are available from independent third-party standards such as the Verified Carbon Standard to measure and project net carbon sequestration (and emissions) levels around sustainable forest and agricultural land use activities. Using an income approach, carbon revenues can be valued by multiplying an average offset market price with the total verified and/or projected tonnes of carbon dioxide equivalent sequestered over a project period in a set geographic boundary. Income can be netted out by considering project development, certification, and any transaction costs.

Watershed Services

Beyond the direct flows of water provision that can be valued through avoided cost, other watershed services such as erosion control, enhanced soil quality, increase in total water yield, stabilization of streamflow distribution, and control of sediment in streams are harder to value accurately, particularly with a rapid community-based approach. For example, valuation of indirect benefits of improved commons management, such as increased crop yields due to enhanced water flows, relies on a technical understanding of hydrological flows in order to accurately attribute the relationship between commons and other parcels. It is therefore incompatible with the current community-based rapid survey approach. A more technical hydrological assessment is possible. Limited benchmarking against existing watershed investment programs could be carried out, e.g. what people are willing to pay for water rights via local user fees. However, in general, pricing for PWS schemes is even more variable and based on sporadic over-the-counter transactions compared to carbon given its inherently localized nature.

Biodiversity

The tool does not develop new methods for valuing biodiversity, but refers users to existing approaches while providing caveats against double-counting. Valuing biodiversity is a complex matter and can encompass both instrumental and intrinsic values. For instrumental values such as crop pollination, relevant in the context of FES's work in India, an avoided cost approach could be used, though it risks double-counting the value of crops. Income approaches could be used in the presence of ecotourism. More broadly, contingent valuation has been the most often used method for valuing biodiversity, given the inability of other valuation methods to gauge passive or nonuse values of biodiversity.[35] Contingent valuation has major limitations, and given its constraints in recognizing the entire range of biodiversity benefits, at its best it provides a lower bound to the value of biodiversity changes.

BUILT CAPITAL[36]

Spiritual value can be attached to both natural environments (e.g. a sacred grove) and human-made structures (e.g. a temple). In the latter case, the tool allows users to include the building value as part of the parcel value, a proxy for how much it may cost for the communities to build a similar structure if the building were destroyed. Generally, the replacement cost approach is used to calculate the building value deducting annual depreciations.

TOOL OUTLOOK

Currently, the Rural Valuation Tool focuses on the direct products supplied by a land parcel, which provides a relevant if not comprehensive accounting of the values that people derive from land. Although the direct use values from water supply are accounted for, more indirect benefits of improved commons management and technically complex ecosystem services such as carbon and biodiversity are less compatible with a rapid bottom-up survey effort, and require more intensive technical studies. Even the initial valuation results based on community-based estimates of direct products such as fodder, fuelwood, and water are not very accurate, and require data validation.

Therefore, for the tool to better reflect the value of the commons to communities requires complementing the rapid bottom-up surveying approach with technical inputs, whether from primary or secondary data sources. And to be truly scalable, it requires an on-the-ground surveying approach with productivity data (e.g. as a function of NDVI, market access, slope) from GIS and remote sensing efforts as envisioned with CAMA techniques.

Chitrawas, India in 2002, 2007, and 2013. Photos by the Foundation for Ecological Security (from top left, clockwise).

CONCLUSION

The need for improvements notwithstanding, lessons from field testing and feedback from FES, communities, relevant practitioners and scholars all reinforced the potential of and interest in using the tool to provide versatile support. It could provide cost-benefit analysis, comparisons of value (e.g. before and after management, poor versus strong social capital), and decision-making support to explore different future scenarios based on varying natural resource management and investment decisions.

In the future, this tool could be synced to value both rural and urban lands across diverse settings, as well as capture additional types of natural capital benefits and social capital factors. The current tool is limited to inland natural resources. For coastal and marine areas, Indufor has developed generic economic models for measuring flows from other activities, such as aquaculture and fisheries production, as well as explored appraisal of real estate properties in rural areas. The social capital survey could be adapted to fit the context of different natural or built resources. It is important to note that additional field testing is needed to test and refine the tool for these other resources.

Chapter 4

Case Study: Valuing the Commons in Rajasthan, India

Community meeting in Kyara ka Khet, Udaipur District, Rajasthan, India. Photo by Indufor North America.

How many pula of fodder do your cattle eat every day?" asked a Foundation of Ecological Security (FES) staff member. Fifteen men, women, and children had formed a circle outside in Kyara ka Khet, a hilly village in Udaipur District, Rajasthan. They burst into laughter.

"Two," some called out. "Three!" chimed in others.

"Why are they laughing?" asked Indufor consultants.

"Wouldn't you find it funny if someone came and asked you about how much food you or your livestock ate every day?" the FES staff member explained. "They see this as entertainment."

"What percentage of that fodder do you get from the Veelva forest?" she asked the group again. Active debate ensued.

Livestock from Kyara ka Khet and three other villages rely on some fodder from the communally managed Veelva forest. However, they also rely on fodder from private cropland and other common lands, depending on the month of the year. The dynamics are complex. Engaging community meetings were followed with late-night sessions spent calculating the total amount of fodder consumption and comparing that against biomass studies. Fodder consumption estimates, multiplied by market prices, fed into a discounted cash flow model. Ultimately, estimating the value of fodder that communities derive from common lands proved to be one of the most difficult questions during the initial piloting of the Rural Valuation Tool.

Piloting efforts in Rajasthan showed that communities would like to calculate the value of their land. In particular, they expressed interest in the potential to use data to advocate for stronger land tenure rights. Through field testing it became clear that valuation based on data collected from rapid rural assessment-style community meetings can provide a useful if rough indication of land value. However, to be sound, community-based valuation efforts must be complemented by strong local NGO intermediary support and data validation efforts, and more technical assessment of ecosystem services and intangible values when relevant.

EARLY MOVERS

In the summer and fall of 2016, members of FES, Indufor, and Ulster University tested the tool on six different commons in the Bhilwara and Udaipur Districts in Rajasthan, together with communities.

FES was an ideal first user of the tool. Established in 2001, the Indian NGO collaborates with a broad network of communities to strengthen tenure rights and land stewardship. In total, FES assists 11,704 village institutions across six ecoregions of India to support ecological restoration on degraded "commons," or communally managed land, including revenue wastelands, forestlands, and Panchayat grazing lands. The organization has a strong history of collecting field data for many years, already having distributed about 500 tablets with GPS capabilities to local teams throughout the various regions, coupled with training on Open Data Kit for data collection. The eventual goal is to establish local portals through which communities can readily access geospatial data for decision-making.

After learning about the proposed rural land valuation tool, FES staff shared their interest in a robust yet simplified approach to valuing the commons. Through consultations with local communities, FES staff and government officials, the team decided to focus on the commons instead of other land types. The commons are critical for livelihoods in India, yet tenure rights associated with them are relatively vague and complicated, presenting potential risks for future land disputes. The Government of India currently has no standardized process to comprehensively value common lands, which also produce services to support intensive or complex mixed land uses (e.g. silvopasture) by multiple communities, susceptible to overexploitation if management is weak.

PILOT SITES

The valuation targeted commons where FES already had a long history of supporting village institutions to improve forest management and agricultural practices. In the villages that field-tested the tool, FES had already helped implement conservation and regeneration practices such as bunding, tree planting, and hydrological works. They had also assisted with local institution building, such as by helping establish village committees to oversee rulemaking on shared resource management. Together, the pilot captured a diversity of closed versus open commons used for a mix of forest and pastoral activities, across grassland and forest ecosystems (see Table 6).

Bhilwara. In Bhilwara District, field testing included tropical semi-arid grasslands in the villages of Mala ka Khera and Mukungarh. These villages are part of the Kalyanpura watershed, which stretches across 5,000 hectares covering around 1,800 households. Livelihoods are largely based on livestock rearing and agriculture, and rearing primarily occurs on the commons through eight months of the year with additional feed derived from food residue for the remaining months.

Land transactions and conflicts with outside interests have been infrequent. However, in recent years, there have been some land encroachments for mining, and anecdotal cases of internal conflicts wherein certain powerful actors within a community encroach on commons for agriculture.

Table 6. Summary of Pilot Villages and Commons in Rajasthan, India

District	Village	Shared commons	Legal classification	Land ownership	Ecosystem type	Values evaluated
Bhilwara	Mukungarh	Open grazing land	Revenue wasteland	Revenue Department	Tropical semi-arid grassland	Fodder Fuelwood
		Closed grazing land	Pastureland	Gram Panchayat		
		Closed reserve forest*	Forestland	Forest Department		N/A
	Mala ka Khera	Open grazing land	Pastureland	Gram Panchayat		Fodder Fuelwood Water
		Closed grazing land	Pastureland	Gram Panchayat		
	Mala ka Khera	Basbaada Mataji Temple	Sacred site			Spiritual (use)
Udaipur	Richwara	Closed forestland	Forestland	Forest Department	Tropical semi-arid forest	Fodder Khakhra flowers Khakhra seeds Behda bark
	Kyara ka Khet					
	Chitrawas					
	Sachariya					

* The Reserve forest in Bhilwara is excluded from pilot valuation efforts in October because it has been completely closed since 2011, preventing the community from providing indicative data on revenues and costs.

In Mala ka Khera, efforts to pilot the Rural Valuation Tool focused on valuing the open grazing land and closed grazing land, which also includes the Basbaada Mataji Temple. In Mukungarh, the pilot also focused on valuing the open grazing land and closed grazing land. These commons are particularly important for livestock grazing and fuelwood collection, as well as spiritual and recreational value due to the temple. Village pastureland development committees were established in both villages in the late 2000s with FES support, with rules regulating access, use, and management of these sites.

Udaipur. In Udaipur District, field testing centered around the tropical semi-arid Veelva forest. The forest has historically been accessed, used, and managed by people from four local villages—Kyara ka Khet, Richwara, Sakaria, and Chitrawas —via a Village Forest Protection and Management Committee (VFPMC). The VFPMC was established in 2002 under a joint forest management (JFM) arrangement in a tripartite agreement between the villages, the Forest Department, and FES. Village livelihoods are largely based on subsistence agriculture, livestock rearing, and daily wage earning. Overall these villages rely more on income from non-timber forest products than livestock products, and have far fewer livestock compared to the villages in Bhilwara.

THE PROCESS

All field testing visits included working sessions with FES staff to develop communications materials on the goals and content of the valuation exercise, and community meetings for data collection and validation. For each commons, the team spent two days with villagers, typically ending with a two-hour meeting each day. Community participation was voluntary. The field testing was completed using paper copies of the survey, later entered into an Excel version of the valuation model, with calculations keeping with the valuation methods explained in Chapter 3. An Android app version of the tool was also troubleshot during the field testing with the aim of providing a more user-friendly interface for data collection and valuation results calculation.

In addition to carrying out community-based survey efforts with FES, Indufor and Ulster consultants also investigated how remote sensing and GIS data could be used to generate natural capital valuations, complemented by computer-assisted mass appraisal (CAMA) approaches.

MEASURING SOCIAL CAPITAL

For each commons, the piloting team asked villagers questions to gauge their level of social capital, with special attention to tenure security.

Findings. Social capital scores, reflected in the discount rates, vary a great deal across the communities and parcels. Discount rates range from 11.66% for Mukungarh's open grazing land down to a much more stable 7.66% for Mala ka Khera's closed grazing land (strongest performer). In Mukungarh, the community has only rights to access, use and benefit from the commons, with no state-backed or legally recognized record. In Mala ka Khera, the community has additional rights to control how the commons is used and to exclude others from unauthorized use of the parcel, with legal backing for these rights. The open grazing land in Mukungarh has no dedicated committee with the specific responsibility to manage or oversee matters related to its use, whereas the closed grazing land in Mala ka Khera does.

For example, if governance of Mukungarh's open grazing land improved to the same level of social capital as the closed grazing land in Mala ka Khera, according to the social capital model the valuation of the land would theoretically rise by a Net Present Value (NPV) of $2,113/ha to $3,511/ha – which is 66% higher than it is currently.

The open grazing land in Mala ka Khera incidentally has the same social capital score as the closed

Community meeting in Mukungarh, Bhilwara District, Rajasthan, India. Photo by the Foundation for Ecological Security.

grazing land in Mukungarh so they share the same discount rate. However, they scored differently on specific questions. For example, Mukungarh's village pasture committee has operated for longer than Mukungarh's, leading it to score better on one measure of the robustness of institutions. However, people in Mala ka Khera rely on the open grazing land for a greater share of their livelihoods compared to those in Mukungarh, which leads it to score better on the likelihood of carefully stewarding the land.

Mala ka Khera's closed grazing land scores just slightly better than Mala ka Khera's open grazing land due to stronger enforcement. Community members reported that decisions made by the village pasture committee are never ignored or left unimplemented on the closed grazing land, whereas they are sometimes ignored or left unimplemented on the open grazing land.

MEASURING NATURAL CAPITAL

For each commons, the team asked villagers questions regarding the benefits and costs they derive or incur from mixed forest and pasture activities on the commons.

Among the six commons valued, the closed forestland (Veelva forest) in Udaipur was the most complex commons in which to conduct thorough bottom-up accounting, given its use by four different villages. Its forest ecosystem also proved more complex in its greater diversity of direct products available for local consumption and sale, compared to the commons in Bhilwara which are primarily used for fodder and fuelwood.

Findings. All pilot parcels, representing both grassland and forest ecosystems, were managed as silvopasture, encompassing a mix of grazing and forest harvest activities. Among their various direct products, fodder was the primary driver of value across all pilot parcels. For the four villages using the Veelva forest, harvesting of fodder accounted for over 70% of the revenues generated from non-timber forest products, supplemented by the collection of khakhra flowers, khakhra seeds, and behda bark. In the grazing lands, fuelwood also provided significant value but still paled in comparison to fodder in total value.

Among the parcels, the Veelva Forest has the highest NPV by far at $1.5M given the overall greater harvest levels and greater diversity of products harvested in the forest. The open grazing land in Mukungarh has the secondest highest NPV by far at $0.7M (valuation with fodder estimates validated by biomass survey), despite having the lowest social capital score of any of the surveyed parcels. This owes to the fact that it features the highest stocking rates for livestock grazing. An estimated 8,000 ruminants across Mukungarh and other villages graze there (including cattle, buffalo, goat, and sheep). This is compared to an NPV of $0.2M for the closed grazing land in Mukungarh, which is grazed by 1,900 livestock over the course of the year. An estimated 930 livestock graze on the parcels in Mala ka Khera, which explains the much lower NPVs of $0.01M and $0.4M respectively for the village's closed and open grazing lands.

NPV per hectare provides a different perspective. The per-hectare value of open grazing land in each village is lower than the value of closed grazing land, potentially reflecting the lower productivity and natural resources available in the less regulated open grazing lands. In Mukungarh, the open grazing land has a lower NPV per hectare than that of the closed grazing land. Beyond its potential lower productive capacity, the open grazing land also has a significantly larger area at 328 hectares compared to 42 hectares for the closed grazing land, which means lower grazing intensity per hectare, and in turn lower fodder consumption per hectare. The NPV per hectare value for Mukungarh's closed grazing land is still very high compared to Mala ka Khera's closed grazing land. Even though the land is more responsibly stewarded in Mala ka Khera, the tool bases valuation on actual use rather than potential use.

Even within a framework of actual rather than potential use, however, the valuation of Mukungarh's land could be an overestimate. If excessive grazing leads to land degradation and reduces the per-hectare productivity of Mukungarh's grazing land over the next 15 years to the point where it could not support the current livestock grazing demands of livestock, it would not be realistic to expect consistent fodder consumption year after year.

The value of the closed grazing land in Mala ka Khera is underestimated given the presence of the Basbaada Mataji temple there as well. Using a very simplified method drawing from the travel-cost method, with back-of-the-envelope estimates of the annual number of visitors that come to the temple for the mela and annual donations, the spiritual and/or recreational value of the temple was estimated at $5.8M. While these figures need to be recalculated and put through major validation, at present they imply that the value of the closed grazing land is in the range of $0.6M/ha. We exclude this from the current summary of figures in order to be conservative.

VALIDATING COMMUNITY ESTIMATES AND THE MODEL

Benchmarking against tax rates and market prices. Drawing from market data available on 99 Acres,[37] Real Estate India,[38] and Nanu Bhai[39] as of February 2017,[40] excluding outliers of prices $10,000/ha and upward, the average market price of agricultural land in Bhilwara District is $1,760/ha, ranging from $156/ha to $5,625/ha. The pilot valuation results for Mala ka Khera and Mukungarh, both in Bhilwara District, average out at $2,595/ha, which is 47% greater than the mean and within one standard deviation.

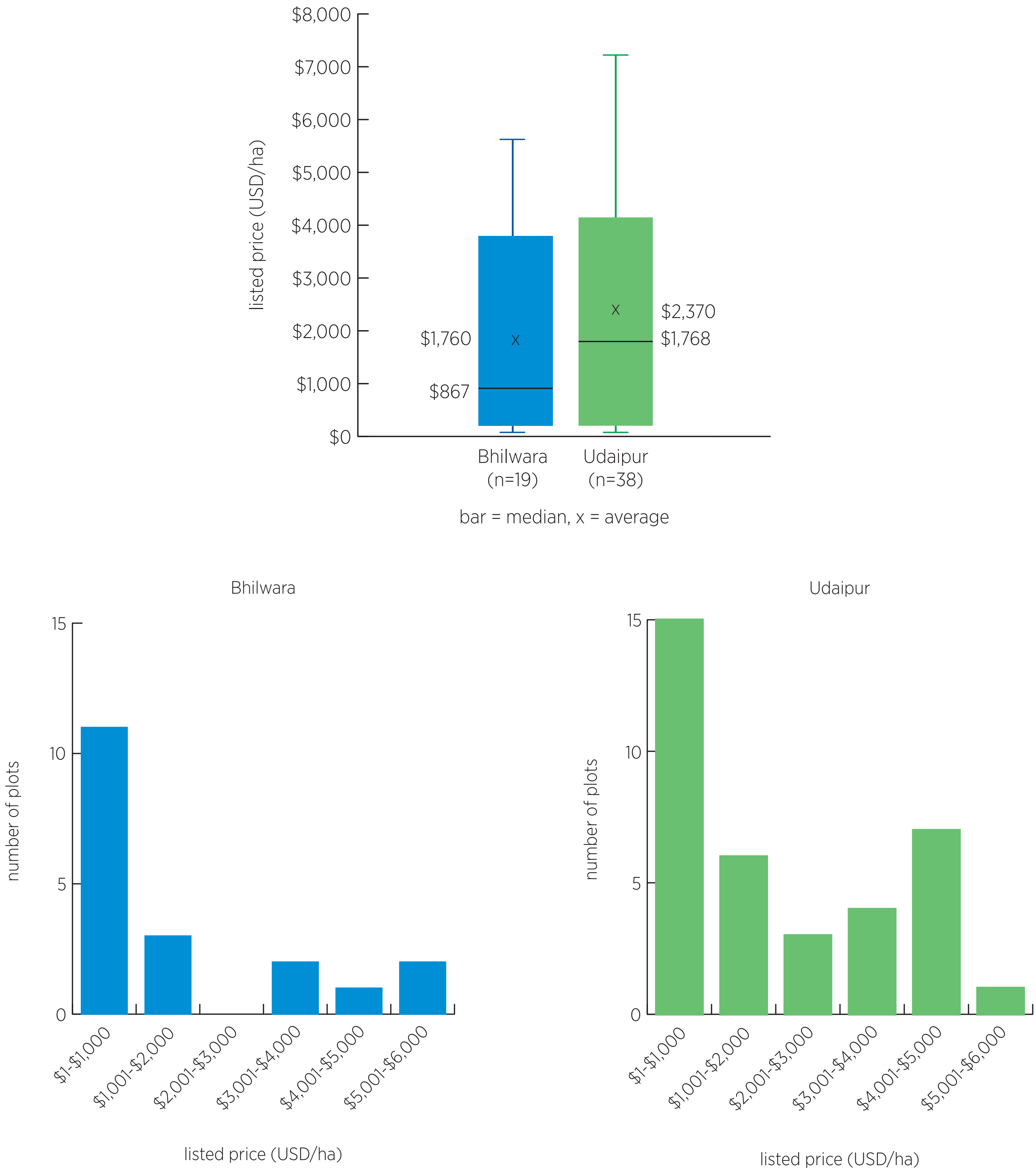
The market price of agricultural land in Udaipur District is higher, at $2,370/ha, ranging from $175/ha to $7,222/ha. The pilot valuation result for Veelva Forest in Udaipur District is $2,108 – which is 89% of the mean and within one standard deviation.

As of April 2015, the District Land Committee (DLC) rates for Mandalgarh, Bhilwara average at $208/ha for non-irrigated agricultural land. This rate is used for tax purposes, and therefore typically lower than market rates. In case of land acquisition, compensation is typically set as 4x the DLC rates in rural areas, or $832/ha in this case. The pilot parcels with the lowest NPV, Mala ka Khera's open grazing land ($1,052/ha) and closed grazing land ($1,290/ha), located in or near Mandalgarh, are within reasonable range of the DLC-pegged compensation rate—26% and 55% greater, respectively. This could create an economic case for communities relying on these common lands, given the current lack of compensation being provided to communities for loss of access to common lands, despite these lands serving as a critical source of livelihoods.

The fact that the initial valuations are within range of established market rates is encouraging. However, the data would need to undergo further validation with the community and other estimates before conclusions can be drawn.

Future projections. In particular, it will be important to assess longer-term sustainability of grazing intensity and management in both villages in order to gauge how realistic it is to project their values out into the future for 15 years. In meetings in the field, people in Mukungarh reported a decline in livestock holdings as incomes diversify to include off-farm employment. It is difficult to model a downward trend for the future with just two years of data available: "present" and "10 years ago." The model is currently set to project the most recent "present" year of data out for 15 years, with the only change being an increase in the market price to adjust for inflation each year. Going forward, the model's assumptions should be adjusted to reflect the community's estimates of anticipated trends going forward, so as to provide a more realistic valuation. Even if people were to stop diversifying and decided to hold their livestock population constant, as mentioned earlier, unsustainable grazing intensity or seasonality could lead to land degradation and reduce the per-hectare productivity of Mukungarh's grazing land over the next 15 years. Conversely, if more sustainable grazing practices such as management-intensive rotational grazing were introduced, high grazing intensity could potentially be maintained over the years without significant land degradation. The uncertainty of these factors should be acknowledged.

Figure 3. Agricultural land market prices in Rajasthan, February 2017



Likewise, the projections for Mala ka Khera should be validated based on community perception of trends going forward. If the decrease in the number of livestock accessing its grazing lands from about 1,660 10 years ago to 930 is any indication, conditions will change significantly over the next 15 years. The valuation is highly sensitive to projection assumptions. None of the community-based estimates for the Veelva Forest underwent scientific validation, and could also use additional review.

Social capital. During the pilot, the social capital survey was conducted with respect to each full parcel, rather than being administered for each land use activity such as forestry, grazing, and water consumption separately. Understanding that there are often distinct rules and rights associated with specific resource types, the valuation results would be improved by establishing unique social capital scores for each land use activity going forward.

Fodder. Scientific validation of community-collected data would also help where possible. Net benefits derived from fodder were initially calculated based on group-deliberated figures on livestock head count, broken down by livestock type, fodder requirements, and rough assumptions about the percentage of fodder requirements fulfilled by a specific land parcel versus other sources in different seasons. A general assumption that livestock need to consume about 2-3% of their body weight on a daily basis was applied across water buffalo, cattle, goats, and sheep. Despite considering these assumptions, total estimated fodder consumption was more than double the biophysical productivity of the land itself, the latter derived from biomass assessments. One possible explanation for the difference could be that people are also grazing their livestock on patches aside from the two specific commons parcels. The community-reported fodder consumption estimates were therefore adjusted by a multiplier of 0.63 to match the biomass survey as the upper bound.

No biomass survey data was available to validate fodder harvest data in Veelva Forest. Generally, the fodder harvest estimates by the community in Veelva Forest should be more accurate given that its members harvest fodder using a cut-and-carry system, as opposed to open grazing in Mala ka Khera and Mukungarh.

Water. When the team sought to value the benefits of water provided by a local earthen pond located in the Mala ka Khera closed grazing land, benefits of the earthen pond far exceeded the actual carrying capacity of the earthen pond when checked against FES data. It was necessary to validate the estimate with water carrying capacity data.

Other. Other community estimates on benefits and costs would also benefit from additional validation, in order to help understand the full margin of error across different reported resource flows.

MODEL SENSITIVITIES

The valuation is generally sensitive to the following elements of the model:

Sovereign risk rate and inflation rate. An essential component of the discount rate, the sovereign risk rate helps indicate the level of potential investment risk in a country based on a macroeconomic aggregate of political risk and legal risk. By default, the model prompts users to input the interest rate of the country's long-term 10-year government bond as a proxy for sovereign risk rate, because most government bonds are traded on secondary markets and their interest rates reflect expectations of global investors. Scholars have developed various approaches to estimate sovereign risk rate with country credit ratings updated periodically as a benchmark. Users of the RVT can also apply other reliable estimates, but should conduct a sensitivity analysis to better understand how the results compare with those that would be generated using the 10-year government bond rate.

Given that the sovereign risk rate and the inflation rate has an endogenous relationship, the Discounted Cash Flow model works well in most situations. Some problems might come up if the sovereign risk rate is

Calf grazing fodder, Mala ka Khera, Bhilwara District, Rajasthan, India. Photo by Indufor North America.

below zero, or the inflation rate is much higher than sovereign risk rate when the country is in high inflation. The country-level data is not applicable at that time, and community-based economics survey is required.

Projecting historical data. The model by default suggests using the arithmetic mean of annual data collected for each variable as the default historical trend to project into the future. The arithmetic mean is based on the measure of central tendency and could be largely influenced by outliers, but it is the best linear, unbiased estimator if the distribution of the variable is unknown, and relatively simple to use in the context of rural appraisal. The user has the option to override the mean with more reliable estimates. During the piloting, it was found that taking an average of data collected for the present year and "10 years ago" would overestimate the value of the land given significant declines in the number of households and livestock. We therefore decided not to use the average, and instead based future projections solely on the data in the present year. This assumption itself could be further fine-tuned through discussions with the community about realistic trends going forward. Other variables, such as the total quantity of fodder consumed by a type of animal in a year, generally can stay more fixed, but should also be discussed, for instance if livestock are suffering from deficits in fodder consumption compared to what they need.

LESSONS ACROSS SITES

The following takeaways from field-testing are most salient for users of the tool or those broadly interested in valuing communally managed land:

1. **Free, prior, and informed consent and equitable representation and participation across villages who use a land parcel are key to ensure community buy-in and data quality.**

   NGOs and other facilitators should ensure that the use of the tool follows free, prior, and

Local waterway in Udaipur District, Rajasthan, India. Photo by Indufor North America.

informed consent (FPIC) principles, and stays true to community interests and sensitive to local conditions. In FES's case, discussions were held with local communities prior to the valuation exercise to understand their perception of the idea of valuation on common lands and identify the key indicators they use to assess their land's value. These meetings were also used to discuss other community affairs, all of which were documented in their village committee resolutions books, signed by both literate and non-literate participants. FES framed the exercise as knowledge sharing between partners, and decided not to compel participation by offering compensation to participants for their time, instead holding voluntary sessions.

The team made efforts to interact with all of the key groups across villages that used a specific commons parcel. For instance, Mukungarh Village in Bhilwara District consists of three habitations that are socially cohesive units in themselves and have varying levels of dependency on open and closed grazing land. Focused group discussions were held with communities in all three habitations to ensure thorough representation. At the same time, during the discussions it was found that besides the three habitations within Mukungarh, people from three to four neighboring villages also accessed and used the open grazing land. To produce mutually exclusive, collectively exhaustive answers in the limited timeframe, the team relied on one village to also estimate the number of livestock from neighboring villages that use the same commons. In the case of the Veelva forest in Udaipur, consultations were held with community members from all of the four villages using the forest. Villagers were able to provide reasonable estimates on the benefits side, but were less well positioned to estimate grazing-related labor costs incurred by other villages. For better results, NGO partners should work with all rather than select social units to value each parcel.

When field testing the tool, women's participation was high in one village, and low in another. Although the need for equitable representation and participation across genders remains a priority, it can be difficult to implement given the limitations of how much an NGO can push the community on gender issues during short engagements.

In cases where the NGO has capacity to do so, we recommend targeted outreach and event planning to ensure stronger turnout of underrepresented or marginalized people at meetings, across gender, caste level, socioeconomic class, age, and literacy level. In settings where entrenched customs segregate certain groups, it may be premature for the NGO to introduce this project, and more gradual measures may be needed first to build community capacity and buy-in.

2. **Creative, locally appropriate survey methods are needed to improve rough estimates in rapid, community-deliberated settings.**

It was hard to achieve a consensus on certain group-deliberated averages, such as livestock holdings. This was particularly true in cases where there is greater variation from household to household, and taking an average across a few vocal participants may be misleading. Also, while people could provide livestock numbers before and after major intervals, it is hard to fill in the years in between because livestock numbers may rise or fall in drought years where cattle are sold off, and more generally as people's income sources diversify.

Community members also could not fully recall revenues and costs on a year-to-year basis, answering in terms of an average good or bad year (e.g. influenced by droughts or excessive rainfalls), and before-management and after-management (where management represents the establishment of village institutions to govern the commons). There was sometimes a 'time drift' in answers.

Facilitators should use phrasing that ensures more precise answers by anchoring respondents to specific, commonly agreed-upon points in time. It helps to have a timeline that graphically documents major events such as the closing of the forest, major droughts, or excessive rainfall. Referencing these points on paper can anchor community answers against consistent points in time. Surveyors may also need to ask additional questions, like how much livestock is typically sold in drought years, to help attribute livestock numbers to specific years.

3. **Treatment of labor costs should factor in realistic assumptions about opportunity costs, even if people are not being paid for their time.**

Initial versions of the valuation results applied daily National Rural Employment Guarantee Act (NREGA) rates to the total number of days that individuals per household spent grazing cattle and harvesting NTFPs. However, this assumption tends to overestimate actual labor costs, as some activities take less than a whole working day, and applying the NREGA rate may not realistically reflect the opportunity cost of individuals in the pilot areas. Some households' alternatives would be to make a daily wage at NREGA or higher rates, while others may not.

For better estimates, users may switch to estimating daily opportunity costs by dividing average household income by the average number of working-age adults per household. They can also ask for the average number of hours spent on each unpaid activity rather than applying the full daily rate.

4. **Validation of community-reported data is needed to adjust for errors.**

As illustrated earlier with fodder, validation of community-collected data was a recurring need. Net benefits derived from fodder were initially calculated based on group-deliberated figures on livestock head count, broken down by livestock type, fodder requirements, and rough assumptions about the percentage of fodder requirements fulfilled by a specific land parcel versus other sources in different seasons.

A general assumption that livestock need to consume about 2-3% of their body weight on a daily basis was applied across water buffalo, cattle, goats, and sheep. Despite these assumptions, total estimated fodder consumption was more than double the biophysical productivity of the land itself, the latter derived from biomass assessments. One possible explanation could be that people are also grazing their livestock on patches other than the two specific parcels.

Similarly, when the team sought to value the benefits of water provided by a local earthen pond on the commons, benefits of the earthen pond far exceeded the actual carrying capacity of the earthen pond when checked against FES data. It was necessary to validate community estimates and adjust the valuation accordingly with biomass survey and water carrying capacity data.

The tool is best used in areas where communities, local NGOs, or others have the capacity to validate data using past data, or to improve record keeping going forward.

5. **An income-based approach can represent the value currently derived by users from a land parcel, but does not represent a parcel's full potential.**

People in Mukungarh have experienced a decline in livestock holdings as incomes diversify to include off-farm employment. It is unreasonable to assume that livestock numbers and fodder consumption will unconditionally rise when a community increases its social capital. The relationship between the land's productive capacity and actual resource consumption depends on the broader context of land use and market dynamics. Even if the land becomes more productive, it might not be drawn upon for maximum sustainable yields. Community responses about resource consumption are therefore an unreliable proxy for the land's productive capacity.

This lesson prompted a need to consider the adjustments to make for a more market-based approach that factors in potential productivity when feeding into a CAMA approach. Even if ecosystem services were stronger under a less intensive harvesting regime, more technical methods to value ecosystem services may not always be feasible to carry out. Valuations weighed toward income-based data in areas rich with ecosystem services may underestimate value.

A technical rather than rapid, bottom-up or group-deliberated approach would generally be needed for a valuation approach based on land productivity. A group-deliberated productivity approach could be used in select circumstances, though it is currently outside the scope of this tool. In Richwara, FES staff guided community participants to fill a chart showing fodder volumes anchored by how much households can harvest each year. Because it covered annual grass fodder, it happened to roughly coincide with communities' perception of overall productivity. For annual grass fodder or annual crops, community estimates of the quantity used can be used as rough proxies of productivity.

However, for perennial species, group estimates of the quantity used cannot be applied as proxies of productivity. This issue of yield modeling for perennial species arises in both grassland and forest ecosystems wherever fuelwood or other products are collected from perennial species. However, it is clearly much more problematic for forest ecosystems and perennial grasslands compared to annual grasslands. Granted, some selective accounting may be easier in forest ecosystems, depending on the system of harvest. For instance, in Veelva forest, the community cuts and carries the fodder from the forest, whereas in Mukungarh and Mala ka Khera, fodder is grazed onsite by livestock. Cut-and-carry systems allow for simpler estimates of how much fodder is consumed from the forest compared to grazing-based production systems.

The tool's users must therefore understand its bottom-up consumption approach. They should take care to ask about multiyear harvest cycles rather than take averages across a couple of years' worth of convenient data. In cases where forest thinning for many years is punctuated by the occasional selective harvest, it is important to be able to project that major harvest going forward, even if the community is only able to provide data for a couple of years with forest thinning activities. If the community has been managing the area long enough on a rotation, they should be able to provide more information.

In addition to these lessons, implementation of the bottom-up approach to rural land valuation yielded other valuable solutions for community engagement, as well as for the underlying valuation methods and scope. They are summarized in Table 7 and Table 10 in Annex 2.

SCALING UP THE RURAL VALUATION TOOL

After piloting the tool in Mukungarh and Mala ka Khera, initial results were shared and validated. A

Rural Valuation Tool meeting with communities at Basbaada Mataji Temple, Bhilwara District, Rajasthan, India, October 2016. Photo by Indufor North America.

Table 7. Initial Valuation Results for Pilot Villages and Commons, October 2016

Commons Parcel	Data Source for Fodder and Water Consumption Data	Area (ha)	Discount Rate	NPV (INR)	NPV per ha (INR)	NPV (USD)	NPV per ha (USD)
Mala ka Khera Closed Grazing	Community estimates	10	7.66%	3,721,598	372,160	$55,824	$5,582
	Biomass survey & water carrying capacity calculations	10	7.66%	860,252	86,025	$12,904	$1,290
Mala ka Khera Open Grazing	Community estimates	35	7.76%	5,581,550	159,473	$83,723	$2,392
	Biomass survey	35	7.76%	2,454,109	70,117	$36,812	$1,052
Mukungarh Closed Grazing	Community estimates	42	7.76%	34,171,489	813,607	$512,572	$12,204
	Biomass survey	42	7.76%	16,592,967	395,071	$248,894	$5,926
Mukungarh Open Grazing	Community estimates	328	11.66%	77,296,944	235,661	$1,159,454	$3,535
	Biomass survey	328	11.66%	46,207,313	140,876	$693,110	$2,113
Veelva Forest	Community estimates	190	7.76%	99,610,667	524,267	$1,494,160	$7,864

larger meeting was organized with about 100 people gathered from eight communities across the Kalyanpura Watershed in Bhilwara. The communities were excited to hear initial results about the value of benefits they derive from common lands, particularly the differences in value observed on managed versus unmanaged commons. Members from villages that were not a part of the initial pilot exercise were also keen to know the value of benefits being generated from the commons they used. For example, members of Nathji ka Khera asked, “We have constructed an earthen pond and several check dams on our common lands. What is the value of water that we are conserving?” Communities were particularly interested in assessing how their efforts to restore land and water resources were helping to improve the overall value of natural resources.

Following the tool’s revisions, FES has expressed interest to use it in other areas to test its versatility. Communities in other states where FES is active, such as Orissa, would account for an even more diverse set of non-timber forest products given the greater complexity of their harvest activities.

FES expressed interest in using the tool as a part of its standard toolbox of engagement with communities using revenue wastelands or other forms of commons. The tool could be combined with decision-making tools such as the Composite Land Assessment and Restoration Tool (CLART), an FES tool developed to help communities plan local interventions around water recharge potential.

On a parcel-by-parcel basis, FES could use the valuation as part of a broader package to negotiate with the government to strengthen collective tenure rights of local communities over common lands through legally binding arrangements. It could also use it to inform tradeoffs around diverting the parcel for other land uses, or provide an alternative compensation value in case a community is displaced. In such cases, the tool could be used to demonstrate valuation before and after management, or with poor versus strong tenure and other forms of social capital. FES is also interested in using the tool to help communicate the winners and losers associated with different land use scenarios.

In addition, FES saw potential application of the Rural Valuation Tool in the context of meeting goals under countries’ Intended Nationally Determined Contributions frameworks. At a much larger scale, CAMA could estimate the value of commons across an entire state and use it to inform broader policymaking on commons. FES staff further expressed interest in using the tool in decision-making exercises to explore future scenarios based on different natural resource management and investment decisions. One such decision could be regarding the number and type of livestock that the community could rear such that they would maximize their returns from it while also managing the land sustainably. The tool could also help facilitate intra-community negotiations over land use and related benefits.

Annex 1

Valuation with GIS, Remote Sensing, and Computer-Assisted Mass Appraisal

Groundtruthing spatial data in Mala ka Khera, Bhilwara District, Rajasthan, India. Photo by Indufor North America.

In its current form, the Rural Valuation Tool is applied one parcel at a time. Use of the tool and access to rural land valuation data are therefore likely to be limited to households, communities, or other social units with strong internal capacity or NGO/other support to collect data and calculate inputs for a discounted cash flow model. Even with strong user capacity, valuation requires data validation. In addition, when looking at scaling up valuation across thousands of parcels, the level of primary data collection required to value land with the tool is not economical or logistically feasible for valuing all relevant land parcels across a particular region or country.

Geographic information systems (GIS) and remote sensing could complement rapid bottom-up survey efforts, providing a reference for data validation at the parcel level. They could also be used to inform a CAMA approach. This annex first discusses the value of GIS and remote sensing to inform valuation at the parcel level. It then describes the role that GIS and remote sensing could play in informing CAMA-based valuation across a broader set of non-surveyed parcels, calibrated with valuation data from surveyed parcels.

GIS AND REMOTE SENSING

Satellite images can provide relevant information to complement community-reported information during the land valuation process. For example, satellite imagery can be used to produce base maps that show land cover. Field testing during piloting in India confirmed that high-resolution imagery can be used to create reasonably accurate land cover maps without having detailed knowledge of a local area.

Unlike land cover mapping, boundary mapping requires detailed local knowledge, which may limit the applicability of satellite imagery. A more realistic alternative is to measure with Global Positioning Systems (GPS), or confirm these boundaries using freely available Google imagery during community consultations.

Once parcel boundaries are established, satellite imagery can also be used to monitor land cover change. Freely available imagery from the United States Geological Survey (USGS) and the European Space Agency (ESA) provides information (10–30-meter resolution images) that can help map the status of natural capital on land, for example by identifying changes in vegetation cover and reservoir levels in line with seasonal changes. This type of information could be used to validate historical data and project trends which can then be used to produce a community-based valuation. Vegetation growth across the commons is highly seasonal, which means consistent image timing is important to allow comparisons. The relative accuracy of biomass estimation is key, as it allows for data validation of community-reported inputs and also for scaling up of the valuation tool through CAMA, which is described below.

COMPUTER-ASSISTED MASS APPRAISAL

CAMA has been used to infer the value of certain properties from an existing database of appraisals, leveraging data on major attributes from a database of already appraised properties. As a statistical model-driven property valuation approach, CAMA has the power to allow the wider use of a limited yet representative amount of evidence on land and property value.

Data on land values are often scarce in rural areas of emerging markets. In India, the country where the Rural Valuation Tool was field-tested, land value data is non-existent for revenue wastelands. In response, inspired by the CAMA approach, Indufor and Ulster University explored the potential to adapt CAMA for complementary use with the Rural Valuation Tool in rural areas. CAMA may be feasible for both the pilot study market and future valuation sites, but requires a larger sample size and a significant amount of ground-truthing in order to be operationalized with rigor.

CAMA is typically carried out in three major stages:

1. Collection and cleaning of data to ensure it is robust and representative
2. Statistical modelling to prepare a valuation model, run in an iterative fashion to build the model that most accurately estimates land values based on market sales evidence
3. Checking model accuracy, comparing the estimated values with the sales price data, against a number of standard benchmark tests

The legitimacy of CAMA model outputs is tied to the rigor, accuracy, and reliability of valuation data inputs. In case of the Rural Valuation Tool, pilot valuations serve as a starting point, playing a role that is equivalent to that played by the sale prices in CAMA for more liquid real estate markets.

The attributes need to be carefully selected to adapt CAMA to complement the Rural Valuation Tool. This is important because there is considerable variability across key attributes, and they may change through time, with no requirement to inform valuation authorities. Building models that are efficient in their use of data and based upon easily obtainable data would be highly advantageous.

To be useful, the attributes used to build the valuation model must be known for all the properties in the wider population being valued. For instance, while fodder productivity may prove statistically significant to value within the sample of properties used to build the model, it cannot be used for CAMA if fodder productivity of properties is unknown for the wider population.

Valuation accuracy depends on the capacity of communities, households, or other social units to use the underlying tool, and the validity of the valuation methods underlying the tool. It is essential that measurements be standardized and definitions of all terminology used be as explicit as possible. Meanings of culturally and geographically unique words (e.g. bigha, which ranges from one-sixth to half a hectare in different parts of India), need to be conveyed explicitly to both survey respondents and team members to reduce the potential for errors introduced from subjectivity.

CAMA accuracy is measured by the extent to which its estimated land value corresponds with the original valuation. Should the CAMA model prove adequate to predict the sample site values, it can be confidently deployed to assess land values in the wider population of sites. This depends upon the sample sites being broadly representative of the population at large and adequate data on significant attributes being known or potentially discoverable for all sites.

MODEL DEVELOPMENT

The bottom-up information collected using the Rural Valuation Tool represents the primary input, with the second component drawn from GIS and remote sensing for inclusion into CAMA. As each land parcel is unique, additional information is required to scale up and provide a wider census to improve the representativeness of valuations. Remote sensing and GIS can help move from valuation of individual or groups of parcels to a mass appraisal of land.

At this stage, given the requirement to use simple but data-rich attributes when developing a CAMA approach, natural capital is crudely defined as the actual biomass of a parcel which is used by the community, where biomass is a proxy for a broader set of environmental quality and productivity.

Social capital on the other hand represents multiple factors including tenure security, institutional capacity, and management practices. Remote sensing at this stage is not applicable to social capital. Relevant GIS data on conflicts at the district level is available for India, but provides a poor proxy based primarily on the observation of negative cases (i.e. conflicts), compared to assessing social capital through discussions with local communities that may also shed light on the positive elements of land tenure and institutional capacity.

Scaling up the valuation methods would be easier if there were a linear relationship between natural and social capital. This could be reasonable, as there is evidence from various cases of commons management, e.g. in community forest management, that communities with greater social capital enjoy higher natural capital. However, there could also be exceptions to the case, for example if strong social capital compelled a community to diversify livelihoods away from natural capital. The exact nature of this relationship in this context is uncertain, and will be clarified as additional parcel data is collected. More realistic at this stage would be to initially refine CAMA methods for natural capital valuation, disaggregated from the social capital elements.

CAMA INPUTS

To keep the model simple for initial scaling up, it would be practical to constrain the analysis to the parcel level. This would involve calculating the average Normalized Difference Vegetation Index (NDVI) or biomass value for each land parcel. Based on the standardized NDVI value, or modelled biomass, all parcels would be placed into one of four quality categories: very good, good, medium and poor based on the level of biomass. In addition, other information including coordinates of the central point of the parcel derived from GIS analysis will be included as input for CAMA. Table 8 shows the simplest input form for CAMA as derived from field surveys and remote sensing analysis.

Although NDVI is considered a good indicator of vegetation presence and vigor, it does not provide a direct measurement of biomass. It is known to vary across different images (even from same sensor) due to sensor geometry, sun illumination angles, and differences in atmospheric conditions during imaging.

Table 8. Example CAMA Inputs Based on Simple Inputs

SN	Name of parcel	Type	Social capital from survey	Natural capital from survey	Area (ha)	Category based on RS	Coordinates (XY)
1	xxxx	Grassland	yyyy	zzzz	nnnn	Poor	nn
2	xxxx	Forest			nnnn	Poor	nn
3	xxxx	Wasteland	yyyy	zzzz	nnnn	Medium	nn
4	xxxx	Grassland			nnnn	Good	nn
5	xxxx	Forest	yyyy	zzzz	nnnn	Medium	nn

As CAMA would require multiple image scenes across different environments, standardization of the NDVI value is necessary using several existing image standardization techniques. Once NDVI values are normalized, they can be used as a proxy for biomass. This approach could be further evaluated using field biomass measurements. A sufficient number of biomass measurements is necessary to develop an NDVI-based biomass model.

Additional analysis of remote sensing images is possible and best pursued using cloud-based processing methods that access freely available satellite imagery.

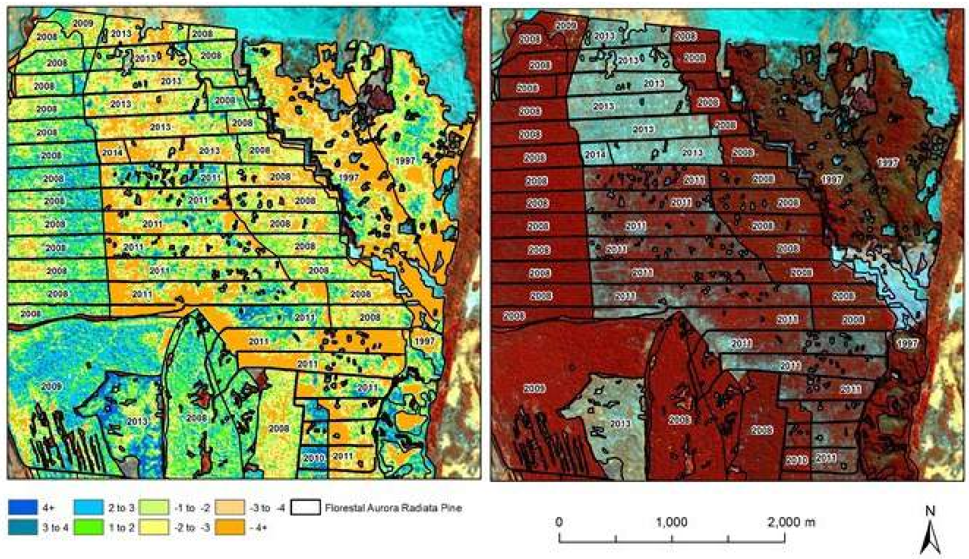
- **Within-parcel analysis**: A high degree of variation of land cover can be expected within each parcel. Further improvements could include identifying the percentage of good medium and poor areas within each parcel, classifying them based on standardized NDVI or modelled biomass. **Table 9** shows an example of the resulting CAMA input form that includes additional information.

This approach is routinely used by Indufor to monitor the productivity of forest plantations. The process uses satellite imagery and in-house routines called Sattools[41] to build a model to evaluate stand performance and variability, and to detect areas of anomalous growth. An example output is provided in **Figure 4**, which compares the satellite image (right) against the derived variation map (left). This routine could be modified and applied

Table 9. Example CAMA Inputs Based on detailed GIS/Remote Sensing Analysis

SN	Name of parcel	Type	Social capital from survey	Natural capital from survey	Area (ha)	Area % Good	Area % Medium	Area % Poor	Trend last 5 years	Coordinates (XY)
1	xxxx	Grassland	yyyy	Zzzz	nnnn	nnn	nnn	nnn	Positive	nn
2	xxxx	Forest			nnnn	nnn	nnn	nnn	No Change	nn
3	xxxx	Wasteland	yyyy	Zzzz	nnnn	nnn	nnn	nnn	Negative	nn
4	xxxx	Grassland			nnnn	nnn	nnn	nnn	No Change	nn
5	xxxx	Forest	yyyy	Zzzz	nnnn	nnn	nnn	nnn	Positive	nn

Figure 4. Example Stand Variation Map



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to further refine the value attributed to each commons parcel, and improve the sensitivity of CAMA outputs.

- **Woody and non-woody biomass:** Grassland biomass as an annual crop is well represented by the seasonality of NDVI time series, but woody biomass—perennial in nature—holds a permanent biomass component as well as a seasonal one. For example, a closed grassland may have very few trees and be managed for fodder production, resulting in a high NDVI value in the peak season that rapidly decreases as the grass is grazed or dries up. A closed forest may record a higher NDVI value throughout most of the year but be overtaken by the closed grassland post-monsoon.

  In summary, the NDVI time series represents both the seasonally changing biomass and the consistent biomass that remains unchanged over time. It is possible to apply techniques such as a Seasonal-Trend decomposition procedure based on Loess (STL) algorithm to decouple the NDVI time series to split out the woody and non-woody biomass proportions.[42]

The proposed CAMA approach is intended to be deployable with an affordable level of digital data inputs. The approach would provide a valuable stepping stone to more sophisticated uses, perhaps harnessing Geographically Weighted Regression and more delineated biomass assessment.

In addition to biomass, other indicators may be factored into an environmental quality index, including market access (potentially approximated by distance to city center, or as a function of population density), slope, and water risk.

IS THE APPROACH ROBUST?

The central limit theorem and the law of large numbers are commonly cited foundations in statistical theory that convey the importance of a sample size being large enough to reflect the behaviors of a desired population. A sample size too small will result in inaccurate, unreliable estimates of value. While observations in a sample must reach a certain level before a model may be deemed reliable, the acquisition of additional data points can often be costly, or in some cases, severely limited. Reichert states that with respect to property valuation models, a sample will ideally have at least 30 observations per variable, with no fewer than 10 observations per variable as a bare minimum.[43] Similar sampling suggestions are echoed by modelling valuation courses taught by the International Association of Assessing Officers (IAAO).

Overall, the outlook for large-scale CAMA execution for estimating annual income, gross income multipliers, and overall value is uncertain. The availability of benchmark stamp rates (such as Rajasthan's DLC rates), 2011 census data, remote sensing capabilities, and explicitly defined survey terminology provide an optimistic outlook for efficient scalability. However, attributes related to both natural and social capital each have unique considerations to address before being able to feed into a larger-scale approach. In particular, there are challenges to accessing standardized data on attributes related to tenure security and land productivity.

The social capital survey requires bottom-up input from communities, households, or other social units, and there is no real analogue for secondary data collection for non-surveyed sites at a regional level. Legal classification has some influence on tenure security but is only one factor. In the pilot areas in India, three legal land types were identified, associated with varying degrees of tenure security: pastureland, forestland, and revenue wasteland. However, there were dramatic differences in the level of social capital even when comparing two parcels that shared the same pastureland legal classification, partly due to the difference in maturity between village pastureland management committees and rulemaking.

Moreover, legal classification cannot be used to determine specific land use, which is relevant for natural capital valuation. From field-based analysis, it has been found that all three of the land classifications encountered during piloting—pastureland, forestland, and revenue wasteland—were being managed as silvopasture, that is, a blend of forest product harvesting and pastoral activities. Initial piloting for a CAMA approach would be best done in an area where de facto land uses are rel-

Variation in vegetation cover, India. Photo by the Foundation for Ecological Security.

atively predictable and consistent with existing legal or other classifications.

More investigation is needed to determine how to reconcile the valuation approach for existing parcels, which is based on current income and resource flows that typically do not match full biophysical productivity or potential. It would also be necessary to know how the rankings of very good, good, fair, and poor would be determined—relative to land values determined in a certain region, or against some absolute biophysical standards.

In the former case, a large and diverse sample size would be required in order for rankings to be somewhat meaningful, otherwise it would be hard to prove external validity. In the latter case, biophysical standards may also need to be evaluated against some intended land use in mind, in which case one is dealing with the challenge of defining highest and best use. For example, scientific standards for what makes 'very good' biophysical productivity would differ if the land were to be used for mining versus generating forest products. By the same token a different standard would hold if the land were to be used for preservation of certain protected species.

In short, such value assumptions would affect the type of multiplier adjustments. Until these questions are solved, it would be challenging to scale up valuations produced from the Rural Valuation Tool using a CAMA approach based on biophysical productivity, given the lack of standardized and representative attributes with which to cross-compare parcels. Instead, the CAMA approach would need to be based primarily on existing valuations drawing on current rather than potential use. Given the bias toward income-based and tangible use values, the value of intangible values may risk being underrepresented.

While remote sensing remains relevant for data validation purposes, it would be difficult to use it to conduct CAMA and estimate the value of nonsurveyed parcels based on surveyed parcels. For more complex forest ecosystems, remote sensing would be insufficient to determine whether a nonsurveyed forest is being used in a similar way to a surveyed one. If would therefore be illegitimate to extrapolate the value from the surveyed forest to also apply to the nonsurveyed forest, if the land uses and harvested products are different in nature.

REFINING THE CAMA APPROACH

There is great potential to develop a robust CAMA approach for rural areas, where some inevitable losses in precision can be counterbalanced by the fact that robust approaches can be executed at scale and be "good enough" for prevailing circumstances. That said, more work is needed before a CAMA approach can be developed for natural and social capital. Land valuation approaches from other jurisdictions may provide some point of reference. For example, the State of Arkansas in the United States bases its valuation of pastureland, cropland, and forestland on average productivity, using income to approximate value, for different soil classes, disaggregated by land use type. Soil groupings are based on the NRCS Land Capability Classification System (US-specific), indicating various limitations, e.g. water, erosion, or shallow/unstable soils. They have 18 different categories, more granular than the initial 4-category system being considered here. Given the difficulty of getting comprehensive soil data in India's case, NDVI could be used as a proxy instead, with other indicators such as slope, water risk, and market access factored in eventually as part of an environmental quality index. A significant body of valuation samples would need to be accumulated for different land use types in India using the Rural Valuation Tool before it could be relied on to estimate the value of unappraised land.

Other next steps for the India-specific investigation include identifying comparable 'markets' based on socioeconomic data from census data, as well as the availability of benchmark stamp rates by property class, as exists in Rajasthan where the initial tool piloting was done. Once an approach is settled upon for the scaling up of natural capital valuation, more investigation is also needed for social capital.

If a CAMA approach is found to be feasible, additional attention would also need to be paid to how the information would be used, sensitivity to cultural norms, and laws around privacy.

Annex 2

Observations and Lessons

Livestock grazing. Photo by the Foundation for Ecological Security.

Table 10 shows the observations and lessons from community engagement and Table 11 shows the observations and lessons from the valuation tool scope and methods from the pilot.

Table 10. Observations and Lessons on Community Engagement in India

Complexity of data collection	
Pilot observations	**Solutions and lessons**
Limited recall. Good community capacity to answer questions but limited to coarse averages, e.g. unable to recall revenue/cost data on a yearly basis. ***Market access.*** Some villages more connected with market than others, better equipped to provide market prices and other numerical estimates.	User-friendly visual anchors (e.g. community timeline, resource map) and follow-up math tables to help answer difficult valuation questions. Anchors for community answers to specific, commonly agreed-upon points in time, e.g. good/bad years, before/after-management.
Community support. Community capacity to answer questions likely lower in similar rural communities without technical support from a key NGO partner or other institutions/individuals. ***Android app.*** The valuation survey, adapted for Android tablets, is catered to English and Hindi-literate users, and hard to fill onsite without follow-up math.	Strong NGO partner and local Community Resource Persons that has cultivated trust and ideally has existing record of working with a community. User guide and training for facilitators.
Harvest/consumption methods. Some items hard to estimate regardless of education level (e.g. in situations where fodder is consumed by livestock grazing directly on the land rather than via a cut-and-carry system). ***Harvest cycles.*** Sparse data on harvest cycles hinders accurate projections of revenues and costs for both grassland and forest ecosystems wherever fuelwood or other products are collected from perennial species; especially problematic for forest ecosystems and perennial grasslands.	Simplification of difficult community-required inputs about resource harvest or consumption, to supplement/validate with NGO/third-party sources (e.g. on livestock daily fodder and water requirements) while accounting for any local variations (e.g. if livestock face a fodder deficit in certain months). Framing of questions to include multiyear harvest cycles for perennial species rather than take averages across a couple years' worth of data, and inputting results in self-filling table rather than sections with projections based on averages.
Limited timing. Community members typically only available for two hours a day for two days on a voluntary basis, making focus group discussions rushed. Sometimes unable to thoroughly go through all questions, categorically skipped investment outlay section.	Time-budgeting for group survey efforts, factoring in participant and facilitator capacity, complexity of ecosystem or land use activity, and the availability of data (e.g. biomass surveys, livestock census data) to validate survey responses Four hours over two days per habitation would be more appropriate for the pilot areas in question.
Over/underestimation. Risks of double counting or overestimating amount of resource derived from a single parcel. ***Accuracy of averages.*** Difficult to get consensus on average livestock counts when significant variation across households, particularly when only select community participants are vocal.	Questions framed using a mutually exclusive, collectively exhaustive %-reliance approach in cases where multiple habitations/villages share one commons, and where communities use >1 parcel to satisfy a specific resource need (e.g. fodder). Data validation and caveats around final valuation based on quality of the data, e.g. with coarser averages compared to in a more technical study.

Representation and participation	
Pilot observations	**Solutions and lessons**
Partner constraints. Representation limited to communities with which NGO partner has pre-existing relationships, making it more difficult to derive mutually exclusive, collectively exhaustive results if some but not all communities using a commons are represented.	Importance of NGO partners to build relationships with all rather than just select communities using a parcel that they intend to value.
Gender and caste. Equal representation and participation varied between visits and between villages visited, most visible differences being between male and female engagement. Female and lower-caste participation has improved over the years, partly due to FES engagement.	Equitable representation and participation across gender, caste level, socioeconomic class, age, literacy level, and leadership level crucial to ensuring equitable engagement and better triangulation of answers.
Community consent and ownership. FES made a deliberate decision not to compel participation by offering compensation to participants for their time, but rather to hold these sessions as optional events based on voluntary consent, with communities as partners.	Free, Prior, and Informed Consent (FPIC) required in advance of tool's use. Ways to ensure the survey process and use of the tool by communities is consensual without compulsion, adapted to local interests and culture. Framing of sessions as knowledge-sharing opportunities and be proactive about returning to share results after data collection.
Survey group size. Survey group size of 10-20 people meant fewer people able to actively speak and contribute during the discussion.	Guidance on trade-offs between having all participants complete the survey together vs. splitting them into smaller groups (which could enable more inclusive participation), as a function of the facilitators and amount of time available.
Coordinated facilitation. Facilitators worked most effectively to guide community participants through the survey when delegated clear and non-redundant roles.	Balance struck between facilitators validating or guiding answers from community participants versus dominating the discussion at the expense of community participation.

Table 11. Observations and Lessons on Valuation Tool Scope and Methods from Pilot

Pilot observations	Solutions and lessons
General	
Defining community. A community is defined here as all households using one parcel, potentially encompassing one or more villages.	Engagement of all habitation units or villages using the parcel individually, to ensure mutually exclusive and collectively exhaustive results.
Community-centric approach. Many natural resource management activities are enabled through government grants. Their revenues are cancelled out by incurred costs so they net out at zero. Other government costs may or may not be cancelled out by corresponding benefits.	Community-centric valuation scope taking the standpoint of the property owner/rights holder, excluding costs incurred by or benefits accrued to outsiders (e.g. by the forestry department who pays for a forest guard).
Mixed land uses. In pilot areas, forest and grassland ecosystems were both used as mixed silvopasture systems, defying more rigid forestland and pastureland categorization.	Adjustment of model to allow for multiple types of land uses to be filled in for each parcel, where the parcel is defined by its tenure and legal classification instead of its land use.
Labor costs. Applying the NREGA rate as an estimate of daily opportunity cost is not sensitive to varying opportunity costs of individuals in pilot areas.	Estimating daily opportunity cost by dividing average household income by the average number of working-age adults per household. Asking for the average numbers of hours spent on each unpaid activity rather than applying the full daily rate.
Low or negative Net Present Values. Valuation results may be lower/negative compared to expectations, sensitive to labor cost assumptions (e.g. if applying NREGA minimum wage rate).	Taking low or negative NPVs as a very conservative valuation when the tool cannot thoroughly estimate key direct or indirect benefit and cost flows.
Natural capital	
Flows vs. stocks. Net benefits captured in the valuation are falling in cases where an increasing number of households in a community diversify their livelihoods to include off-farm sources, even if overall land productivity remains high or increases. ***Perennial species.*** For perennial species, community estimates of the quantity of consumption cannot be used as proxies for productivity given their longer-term harvest cycles, where the extent to which stocks are left standing between years affects growth rates and productivity.	Clarity that the community-based valuation only reflects benefit/cost flows based on the community's reported historical/current rather than ideal potential use of full stocks available on the parcel. Adjustments and refined sampling techniques needed to ensure that community-based valuations could be used to infer the value of other similar landscapes with similar land uses, crucial to feed into CAMA approach. Supplementing of income approach with productivity-based approach using GIS/remote sensing sources.
Direct products vs. end products. Accounting for fodder, fuelwood, or water individually as direct products rather than accounting for end products is easier from a data availability and quality standpoint, given the limited community capacity to account for all end products, and interest in the value derived by the land itself rather than other inputs for value-added end products.	Accounting for benefits and costs associated with raw, unprocessed direct products rather than value-added end products (e.g. livestock-based products such as milk and wool, value of non-sale animals in terms of useful life of livestock as annual flows).
Tangible vs. intangible. Valuation of intangible forms of natural capital run into data gaps related to market pricing and quantification of natural capital supply itself, therefore incompatible with the current rapid community survey approach that relies on group-deliberated back-of-the-envelope estimates.	Accounting for tangible use values of ecosystem services, such as water supply as a lower-bound proxy. Using technical studies to value intangible values, such as carbon.

Direct vs. indirect. Valuation of indirect benefits of improved commons management, such as increased crop yields due to enhanced water flows relies on a technical understanding of hydrological flows in order to accurately attribute the relationship between commons and other parcels, incompatible with the rapid community survey approach.	Using technical studies to provide an estimate of indirect benefits of improved commons management.
Spiritual and cultural capital	
Cost-based approach. The current conservative, cost-based approach does not capture a larger set of spiritual benefits. The number of hours spent on site may not be strongly correlated with the actual spiritual benefits from the site.	Clarification that this approach only captures the willingness to pay (WTP) in actual and opportunity costs to maintain and access a spiritual site.
Computer-assisted mass appraisal	
Productivity overlay. Given the frequent disconnect between resource consumption and resource availability, an income-based approach does not reflect the full value of the land. Primary collection of productivity data can be costly.	Use of remote sensing and geographic information system (GIS) technology can help assess productivity at scale through the creation of an environmental quality index using indicators such as NDVI (normalized), market access, slope, and water risk, potentially overlaid with land use classification

Grazing land in Mala ka Khera, Bhilwara District, Rajasthan, India. Photo by Indufor North America.

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