Enlisting Ecosystem Services with the DoD

Quantification and Valuation of Ecosystem Services to Inform Base Management

The Natural Capital Project (NatCap) is collaborating with the Department of Defense (DoD) to develop tools and approaches that map and value ecosystem services in diverse ecosystems and military contexts of DoD installations. Using our InVEST models, we are customizing natural capital valuation methods for the military context, which demands a balancing of immediate training capacity needs with investments in long-term resource planning. Better information about the tradeoffs and synergies between land use and ecosystem service provision will help render base management more sustainable, supporting the ecological environment as well as the military mission.

In 2011 the DoD initiated a three-year pilot project with NatCap to expand its long-term commitment to sustainable development. Ecosystem analyses are being conducted with InVEST models on three bases: Joint Base Lewis-McChord (JBLM) in Washington State, Ft. Pickett in Virginia, and Ft. Benning in Georgia. While each of these bases has distinct ecosystems and resource management issues, they share the imperative to maintain training capacity and also manage the impact of their activities on the training grounds. We are working with military personnel at all three DoD bases to map ecosystem service provision and value, to specify tradeoffs between training activities and environmental regulation compliance, and to generate future scenarios under different management objectives.

The DoD manages 25 million Acres of Land, 1% of the entire USA

As the third largest federal land management agency, the DoD has broad influence on resource management practices in the U.S. With over 25 million acres of land in over 425 military installations, the US military training areas represent many different ecosystems in the US. These lands are home to over 420 species currently listed under the Endangered Species Act (ESA), and another 500 at-risk species that may be listed without proper management. The DoD's exploration of an ecosystem services approach is a critical step in enhancing the military decision process to reflect nature's benefits, and in tailoring management strategies to preserve them. With the help of InVEST models, environmental decision makers and natural resource managers in the DoD will be able to:

- **Quantify, map & value** the Army's natural capital on three distinct bases
- **Manage conflict** between training and safeguarding natural resources
- **Plan for the future** resource needs of US Military base management

Preliminary Results

- **InVEST can help the DoD achieve its mission of military readiness while meeting current and future regulatory requirements** for habitat conservation of listed species, greenhouse gas emissions, and water quality. InVEST outputs can inform practical strategies to maintain diverse landscapes necessary for military training.

- **Modeled and mapped the provision of ecosystem services** under alternative future management scenarios, illuminating the tradeoffs and broader implications of DoD land and resource management decisions.

- **Developed new models for Military Training:** Explored military training as an ecosystem service and developed new prototype models for InVEST software for use on DoD bases.

- **Developed new models for threatened species habitat:** Applied risk-assessment models to map and predict the occurrence of four sensitive species at JBLM in prairie ecosystems. Spatially explicit outputs identified areas of interest for habitat restoration specialists.

- **Tailoring InVEST for the DoD.** We are creating a unique version of our InVEST User's Guide for Army personnel. This will enhance the knowledge-transfer to military GIS analysts and ensure the applicability of InVEST to diverse military contexts.

NATURAL CAPITAL PROJECT:
■ Department of Defense

Ecosystem Services

■ **Military Training:** Maintaining diverse environments for on-base training is essential to the DoD. Spatial managers must balance priorities to maintain landscapes for intensive training maneuvers and also protect habitats and limit invasive species.

■ **Sensitive Species:** The DoD is responsible for protecting over 420 species listed as threatened or endangered under the ESA, and over 500 at-risk species that inhabit lands on military installations. DoD lands are also home to over 70 species that are found nowhere else in the world.

■ **Timber Production:** Some DoD installations conduct forest thinning and clear cutting to create training sites and species habitat. Harvested timber is partially used by the installation and partially sold to communities for income.

■ **Carbon Storage & Sequestration:** Trees and grasslands store carbon in their standing stocks and sediments, creating long-term reservoirs of sequestered carbon on DoD bases.

■ **Sediment Retention:** Vegetation holds soil in place and captures sediment moving over land. Bases such as Ft. Pickett and Ft. Benning must monitor sediment flow to comply with water quality regulations.

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A Forward-Thinking Mission: Securing Resources for the Future

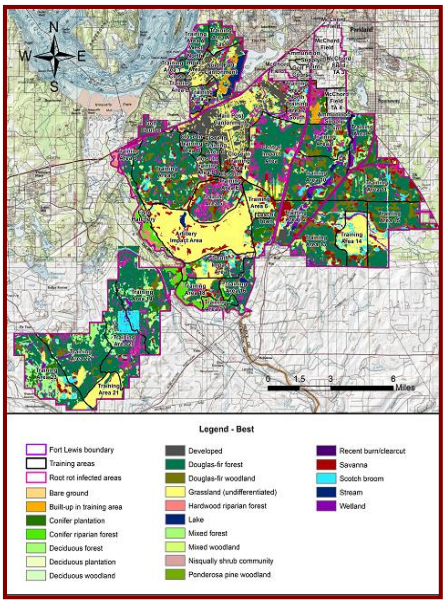
The US military is actively transitioning from a compliance-based environmental program to a mission-oriented sustainability approach as it plans for projected changes in force structure and training. While DoD installation managers already use GIS information, on-base restoration techniques have been limited to reactive approaches to mitigate degradation. Until now, the Army has lacked mechanisms to implement changes to training programs while also ensuring the endurance of the natural training environment.

We are working with military decision makers to improve the efficiency of base management through ecosystem services valuation. This process will allow stakeholders to better understand the consequences and tradeoffs of land-use decisions and it will provide the information they need to plan for the future. Running InVEST scenarios will assist the military as it changes over the next decades to conduct new types of training, use new equipment, and increase training capacity. At JBLM, Ft. Pickett, and Ft. Benning, the Natural Capital Project is demonstrating how a systematic, spatially explicit, and long-term approach to ecosystem services valuation will help the Army quickly adapt their training programs to these changing military needs.

Applying InVEST at Joint Base Lewis-McChord (JBLM)

JBLM is under pressure to protect the integrity of its prairie and oak woodland habitats, which provide ideal landscape conditions for a variety of Army training needs (e.g., open areas for off-road maneuvers and digging activities) as well as for sensitive species such as the Taylor's Checkerspot butterfly (pictured above, left) and the Mazama pocket gopher. InVEST is providing planners at JBLM with knowledge about the trade-offs and synergies of management strategies in order to maximize training capacity while protecting critical habitats. We are modeling and mapping four ecosystem services at JBLM:

- **Sensitive Species Habitat Risk**
- **Timber Production**
- **Carbon Storage and Sequestration**
- **Suitable Land for Military Training**



Map 1. Land-use classes on Joint Base Lewis-McChord

Evaluating Ecosystem Services at Fort Pickett

At Fort Pickett, as at JBLM, the DoD must undertake measures to protect the environment from intensive training maneuvers, particularly those occurring from heavy vehicle activities. They must also manage endangered species such as the Michaux's Sumac, control erosion impacting threatened freshwater species of the Nottoway River, and manage a vast network of associated wetland areas. NatCap is currently exploring land management scenarios to fulfill these responsibilities and comply with environmental regulations, particularly those relating to Total Maximum Daily Load (TMDL) of sediment export and requirements of the National Environmental Policy Act (NEPA).