



Enlisting Ecosystem Services

Quantification and Valuation of Ecosystem Services to Inform Base Management

The Natural Capital Project 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 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 an effort to expand its long-term commitment to sustainable development, the DoD initiated a three-year pilot project with the Natural Capital Project, during which ecosystem analyses will be conducted with InVEST on three bases: Joint Base Lewis-McChord in Washington State, Ft. Pickett in Virginia, and Ft. Benning in Georgia.

While each of the three 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 (an area as large as Kentucky) 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, and another 500 at risk species that may be listed soon 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, decision-makers in all divisions of the DoD will be able to:

- **Quantify, map & value** the Army's natural capital on 3 bases
- **Manage conflict** between training and natural resource management
- **Plan for the future** resource needs of US Military base management



Preliminary Results

■ **InVEST can help the DoD achieve mission of military readiness and training while meeting current and future regulatory requirements** for habitat conservation for listed species, greenhouse gas emissions, and water quality and maintaining realistic and diverse landscapes for military training.

■ **Modeled and mapped the provision of ecosystem services** under alternative management has illuminated the tradeoffs and broader implications of land management decision.

■ **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, endangered, and invasive species habitat:** Applied risk-assessment models to map and predict the occurrence of sensitive and invasive species at JBLM in forest and prairie ecosystems and identified areas of interest to 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.





Ecosystem Services

■ Military Training Capacity:

Maintaining diverse habitats for military training on base is of primary importance to the DoD, while still balancing the often competing needs of maintaining habitats for sensitive species and limiting invasive species.

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

■ **Timber Production:** Some DoD installations sell trees on their land for timber and pulp, to clear land for training and to offset the cost of land management.

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

■ **Project Area:** The DoD is the third largest federal land managing agency in the US, managing over 25 million acres of public land (about 1% of all US land) in over 425 military installations.

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A Forward-Thinking Mission: Securing Resources for the Future

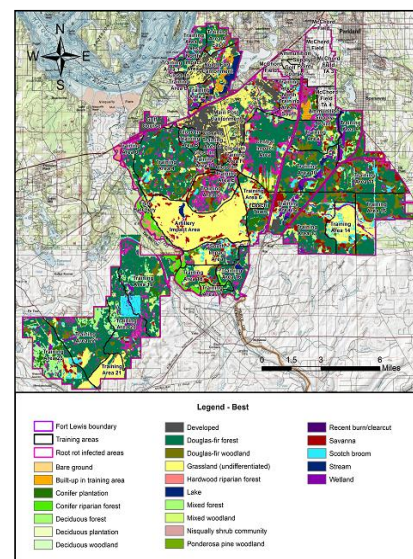
The US military is actively transitioning from a compliance-based environmental program to a mission-oriented sustainability approach as it plans for projected changes in force structure and training. While DoD installation managers already use GIS information, on-base restoration techniques have been 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. 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. We are working with military decision-makers to improve the efficiency of base management through ecosystem services valuation. It 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. 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 habitat, 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 and the Mazama pocket gopher. InVEST will provide 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 and Value
- Carbon Storage and Sequestration
- Suitable Land for Training Capacity



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, and control erosion impacting several threatened freshwater species on- and off-base. The Natural Capital Project is also working to assess the potential impacts of future environmental regulations on Army land decisions, such as those related to Total Maximum Daily Load (TMDL) of sediment export. We are currently working with land managers at Ft. Pickett to identify their priorities for alternative management scenarios, and address their land-management challenges using our InVEST software suite.