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. Targeted analyses of the tradeoffs and synergies between land use and ecosystem service provision on training lands 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 model the ecosystem service provision and value, explicate tradeoffs between training activities and environmental regulation compliance, and generate future scenarios under different management objectives.

InVEST outputs can inform practical strategies to maintain diverse ecosystems supporting the operation of military training activities.

As the third largest federal land management agency, the DoD has broad influence on resource management practices in the US. 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 reflects an effort to incorporate environmental values early in the military decision process, and to tailor management strategies to sustain them over long-term time scales. Our application of InVEST on Army installations aims to demonstrate methods 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

- **Modeled, mapped and analyzed key ecosystem services at Joint Base Lewis-McChord (JBLM):** Applied InVEST models under four scenarios of budgetary constraints and training intensities, and analyzed tradeoffs among carbon sequestration, prairie habitat, timber production, and training capacity. Our analysis suggests regions where investing in ecosystem services will be cost-effective while fulfilling management and mission objectives.

- **Developed new models to integrate analysis of environmental issues and training impacts:** Explored military training capacity as an ecosystem service by developing new prototype models for use on DoD bases. Our application at JBLM explores both vehicle and infantry training capacity as relevant services.

- **Adapted InVEST models for threatened species habitat:** Applied risk-assessment models to map and predict the occurrence of sensitive species at JBLM in prairie ecosystems. Spatially explicit outputs can identify areas of interest for on-base habitat restoration specialists.

- **Tailoring InVEST User's Guide for the DoD:** NatCap is creating a unique version of the InVEST User's Guide for Army personnel to enhance the knowledge-transfer to military GIS analysts and ensure the applicability of InVEST to diverse military contexts.

NATURAL CAPITAL PROJECT:
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Ecosystem Services

Military Training: The maintenance of 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.

Shan Ma, Ph.D.
Economist
mashan@stanford.edu
www.naturalcapitalproject.org

A Forward-Thinking Mission: Securing Resources for the Future

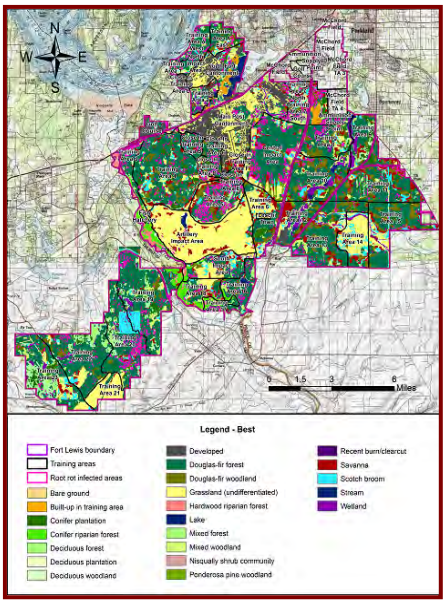
The US military is transitioning from a compliance-based environmental program to a mission-oriented sustainability approach as it plans for projected changes in force structure and training. While DoD installation managers already use GIS information, on-base restoration techniques have been limited to reactive approaches to mitigate degradation.

NatCap is working with military decision makers on three US installations to suggest methods of improving the efficiency of natural resource management through ecosystem services valuation. This process will enable installation commanders to better understand the consequences and tradeoffs of land-use decisions and can inform their development of Army planning documents such as required Integrated Natural Resource Management Plans (INRMPs), which already include considerations for ecosystem services (e.g., habitat). Running InVEST scenarios can assist the military's transition to new types of training, new equipment, and potentially increased training capacities. At JBLM, Ft. Pickett, and Ft. Benning, NatCap is demonstrating how a systematic, spatially explicit, and forward-thinking approach to ecosystem services valuation will help the Army adapt their planning and training programs to these emerging 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 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 have modeled and mapped four ecosystem services at Joint Base Lewis-McChord (JBLM):

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



Map 1. Land-use classes on JBLM

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).