

## Recent Research Endeavors - Article Abstracts

### **Research Interest and Specialization**

*Primary:* Landscape-wide environmental changes, water resources, riparian ecosystems, and ecosystem disturbances and plant succession

*Secondary:* Wetlands, Floods, and Glaciers

*Regional Focus:* Tibet, Arctic; Rural America

### **Recent Article Titles**

*Land Between Water: Landscape Changes of the Eastern Shore*

*Plant Succession Following Surge and Retreat Events of the Bering Glacier, Alaska*

*Tibet: Landscape of Tradition and Change*

*Patterns of Montane Forest Cover and Deforestation in the Kham Region of Eastern Tibet, China*

*Deforestation, Flooding, and Water Quality in Headwater Streams of Eastern Tibet*

*The Transformation of Forest and Marsh in an Agricultural Landscape*

*Benthic Macroinvertebrates as Water Quality Indicators in Streams of the Central Adirondacks*

*Why We Need Nature*

### ***Land Between Water: Landscape Changes of the Eastern Shore***

*Purpose and Abstract:* This article explores the early settlement patterns of the Eastern Shore of Virginia and Maryland and analyzes how human occupation has impacted the natural ecology of the region. The Eastern Shore is an isolated land between ocean and bay where estuarine, marine, and terrestrial ecosystems function in concert and provide the backdrop upon which human activities take place. Wave-pounded barrier islands merge into calm back bays, and broad saltwater marshes rise to join freshwater marshes and inland swamps. Forested flat lands gradually give way to slight uplands and more forest, only to meet marshes at the water's edge once again. The daily rhythm of all life is shaped and reshaped by the sea, and the ebb and flow of tides are as constant as changes on the land. Barrier island, forest, swamp, marsh, and agricultural landscapes of the Eastern Shore have been altered by longstanding human occupation. It is ironic that the Eastern Shore is among the first settled lands in the United States; yet today it remains isolated and sparsely populated. Megalopolis, the great wash of American humanity, spreads north and south along the east coast and fails to engulf the region. Despite a small population, natural and cultural landscapes look

nothing as they once did. As John Smith predicted the land gave up its riches for “mans sustenance” through firs, fishes, trees, and fertile soils, though human success today remains a struggle.

Seven on-site transects running across the peninsula, satellite imagery, and air photos provide the means to survey the region. Barrier Islands are the least changed landscape. The primary impact to the islands was grazing by swine and cattle. Tourist related activities and development poses some threat; however, most of the barrier islands are now protected by private environmental organizations and as state and federal parks. Marshes throughout the region are heavily degraded or no longer exist. As much as 72% of marshes have been moderately, severely or completely degraded. Historically most of the change was caused by diking and draining for agriculture and grazing, today the greatest threat is rising level. Forest was the principal landcover on the Eastern Shore. Greater than 75% of the area is now deforested and there are no original or old growth forests left. Forests were primarily cut and burned for farmland, timber, grazing, charcoal, and development. The species composition of areas that remain forested have likewise been changed. Loblolly pine is the dominate tree species and often is grown as a monoculture. Forested wetlands and swamps once occupied all the riparian lowlands and depression. Most of these areas are now cut, drained, or burned of their original habitat. Forested wetlands are found in thin patchy ribbons along streams because most were converted to rich farmland with easy access to water transportation. Overall the main changes to the swamp landscape are: drastic decrease in area, less mature forests, increased open water, and the proliferation of red maple, sweet gum and pines reducing baldcypress, black gum and white cedar habitat.

Agriculture is responsible for most of the landscape changes in the region. Fully one third of the land cover is farm. Large farms dominate the landscape and do not allow for the development of natural borders and patches that would be expected between smaller farms. Smaller plots failed because they were overworked and could not provide their owners with a living. Tobacco was the principle crop of the early settlers, but eventually failed after exhausting the areas soils. Corn replaced tobacco as the main cash crop and later white potatoes harvests brought some degree of notoriety and prosperity to the region. Today chicken farming dominates the landscape.

Smith described the region as perfect for settlement; with a caveat, those that settled had to be willing to change the land through hard work to earn prosperity...”heaven and earth never agreed better to frame a place for means of habitation being of our constitutions, were it fully manured and inhabited by industrious people” (Smith 1612 from [virtualjamestown.org](http://virtualjamestown.org) 2007). Despite their hard work most of the region’s inhabitants have not economically prospered. Population growth is clearly not depended on initial settlement. With over 400 years to develop the regions remains largely isolated. For better and worse industrious people settled the land and changed each of the major natural landscapes – barriers island, marshes, forests, forested wetlands and swamps, to favor a land remade by agriculture.

### ***Plant Succession Following Surge and Retreat Events of the Bering Glacier, Alaska***

This research documents the succession of plant communities from ice and rock strewn barren ground along the margins of Alaska's Bering Glacier to biologically diverse temperate rainforest. Glacial surges are catastrophic to plant communities. The proglacial terrain at the Bering Glacier has been significantly reworked and voided of vegetation following multiple surge events. The immediate overridden landscape is unique, in that few traces of once flourishing plant ecology remain. Vegetation is clearly stratified based upon the year in which the terrain was overridden. The most recently glaciated surfaces are situated closest to the glacier and are habitat for the earliest colonizers (pioneer species), whereas those areas successively further away show a chronological sequence of later communities. The purpose of this research is to determine plant composition and frequency following glacial retreat on three different aged surge surfaces 1993, 1966, and 1922; and, to compare plant composition on 1993 & 1966 glacial surge surfaces at the push moraine.

From the glacier to the forest, species richness and evenness increase. The region nearest the glacier, the herbaceous region, is dominated by Dwarf fireweed. Rocky, nutrient-poor mineral soils provide little agreeable habitat to plants; yet, within five growing seasons, hardy species of fireweed and herbwillow colonized. Small Black cottonwood and occasional willow and Sitka spruce were found, indicating a tolerance model of succession rather than pure facilitation. Sitka spruce and other woody species perishes after one year of growth. Moss transported by the glacier and deposited on barren land provides the best mechanism for increased plant survival. The middle scrub/shrub region is dominated by alder and to a lesser extent willow. With increased progression from the glacier, alder grows into dense thickets. Nitrogen fixing alder are essential to the evolution of forest habitat. The temperate rainforest region is dominated by even-age stands of Sitka spruce, followed by Black cottonwood and occasional Western hemlock. The understory is dominated by dead alder and Devil's club and occasional patches of muskeg.

### ***Tibet: Landscape of Tradition and Change***

Tibetans view the environment as an interrelated balance within which humans and nature coexist. Overconsumption of resources is discouraged, and the taking of life is forbidden by Buddhist practice. However, as traditional people meet the modern world, checkerboard patterns are carved into forested mountain slopes, pollution runs freely in once pristine waters, erosion lays grasslands bare, and wildlife is stripped from the land. While Chinese annexation may lead the list of blame, globalization, modernization, and necessity are likewise responsible. This paper will explore the changing Tibetan Landscape and the fragile relationship shared between culture and environment.

In Tibet, isolation and tradition are as deep as the land is vast (see Picture 14). But, China compels modernity and, willingly or not, Tibet is going global. Development at all costs takes precedence over cultural and landscape change. Modernity is not improving the living standard of Tibetans at the same pace that it is changing and impairing the landscape. The Qinghai-Tibetan Railway has

created social and economic opportunities at the expense of tradition and the environment. While the Railway is intrusive, lessons were learned - good stewardship has sustained value. Grasslands cover most of the Tibetan Plateau. They shape the region's identity and form the basis for most livelihoods. These lands are fragile, and poor grazing practices beckon desert-like conditions. The rapidly increasing human population on the Plateau leaves little elbowroom for a landuse that requires vast amounts of space. Tibetan forests are complex and rich in life, because they range along an elevational gradient of extremes. Unfortunately, forests are being cut at an alarming rate by commercial loggers and, to a lesser degree, by pastoralists. It is easy to blame China for landscape-wide degradation of grasslands and forests; but, the reality is that traditional practices play a role. Immediate needs place more livestock on the land and fell more trees. However, with care and cooperation, landscapes can recover. Land is the stage upon which the drama of life unfolds, and like no other place, in Tibet, the stage remains uncertain.

### ***Patterns of Montane Forest Cover and Deforestation in the Kham Region of Eastern Tibet, China***

ABSTRACT - This paper examines patterns of montane forest cover and deforestation in the Kham area of eastern Tibet Autonomous Region and western Sichuan Province, China. Field study sites include montane locations in Kham, along a 650 kilometer, east to west trending arc of the greater Himalayan Mountains. The objectives of this research were to: 1) establish the composition, density, and age of trees in recently forested and deforested areas; 2) compare and contrast deforested areas to virgin stands within the same physiographic setting, and 3) determine forest cover using satellite imagery.

Field data was collected at six locations, with multiple 1x30 meter transects at each site. We recorded the species, diameter, and density of tree cover. Dung piles were counted to quantify the extent of grazing. In deforested areas, we aged stumps by counting annual growth rings. Landsat and Aster imagery was utilized to identify and map forest cover. In-situ GPS reference points were employed to confirm field positions and to mark transects.

High elevation areas (> 3500 m) were dominated by spruce (*Picea*) mingled with subclimax populations of fir (*Abies*) and aspen (*Populus*). Pine (*Pinus*) stands dominated at lower, moister elevations (2800-3200 m). Spruce, fir, and pine forests were targeted for commercial logging. Commercially harvested spruce and fir ranged between 100-400 years in age. Pines 20 years and older were harvested at lower elevations. Extensive cutting of younger, smaller diameter trees for local consumption occurred in forests near inhabited areas. Replanting seedlings to replace harvested timber was not evident.

### ***Deforestation, Flooding, and Water Quality in Headwater Streams of Eastern Tibet***

**Abstract:** Headwater streams of Eastern Tibet are remote. Little is known about the impacts that deforestation has had on these streams. This poster examines channel stability and basic water quality parameters in deforested headwater streams of the Tsangpo (Brahmaputra) drainage basin in Eastern Tibet. The study site ranges from east to west for approximately 250 kilometers between Draksum-tso and Rawok-tso montane lakes. Small tributary streams of the Yi'ong, Yarlung, and Parlung Tsangpo Rivers define the study area. Sampled streams meet three criteria: located in a mountainous environment, maintain an active channel width of less than 5 meters, and situated between 2,800 and 4,100 meters. By comparing 5 control streams in forested areas to 25 streams in deforested areas with similar physical settings, patterns of stream degradation emerged. A modified version of the United States Forestry Service's Stream Reach Inventory and Channel Stability Evaluation was used. Basic measures of water quality known to be impacted by deforestation, including temperature, turbidity, and total dissolved solids, were sampled. More than half of all streams in deforested areas were ranked poor, while all streams in forested areas were ranked excellent. Common to deforested upper stream banks were steep slopes, mass wasting, and debris jam potential. Lower banks showed little improvement with inadequate overbank capacity, lower rock count and size, and many obstructions. Deforested areas consistently demonstrated streams with higher temperatures, turbidity levels, and total dissolved solids. Heavy grazing in deforested areas contributed significantly to overall poor bank stability and water quality.

### ***The Transformation of Forest and Marsh in an Agricultural Landscape***

**Purpose and Abstract:** This article focuses on the transformation of forest and marsh on the Delmarva Peninsula. Forest and marsh are the principal natural landscapes; however, they have been degraded and severely diminished in size by a cultural landscape that favors agriculture. Agriculture has naturalized as part of the cultural ecology to become the expected landscape. Only small, disconnected forests that have been cut many times remain. There are no original forests. Forests were primarily cut and burned for farmland, timber, and grazing. The species composition of areas that remain forested are changed. Loblolly pine is the dominant tree species and often is grown as a monoculture. Marshes have fared slightly better with some still intact, yet depleted. Historically most of the change was caused by diking and draining for cropping and grazing, today the greatest threat is rising level. Over time, one type of agriculture has changed to another, occupying increasingly larger areas, rather than allowing the natural landscape to return. Tobacco and potato farming played a central role in the economic development of the area. Today, chicken farming prevails and chickenfeed fields of corn and soybean dominate the land.

## ***Benthic Macroinvertebrates as Water Quality Indicators in Streams of the Central Adirondacks***

ABSTRACT - Benthic macroinvertebrates were collected, identified, and quantified from 50 stream sample sites of the South Central Adirondack region of New York State, and these results were compared to chemical water quality parameters (pH, dissolved oxygen, and conductivity) in order to determine the accuracy of using biological indicators in stream quality assessment. These organisms are excellent water quality indicators because they cannot migrate to different locations when they are in their early life stage forms, and therefore, can be used to determine site-specific stream conditions. Specific taxa, such as mayflies, stoneflies, and caddisflies, cannot tolerate aquatic pollution, need large amounts of dissolved oxygen in order to survive, and are indicators of good water quality. Leeches, aquatic worms, and midges are able to survive in more polluted environments, require small amounts of dissolved oxygen to live, and are indicators of poor water quality. Benthic macroinvertebrates were collected using Environmental Protection Agency approved field equipment and identified based on taxonomic order. Biotic Index and Percent Model Affinity were calculated for each of the 50 sample sites and compared to chemical water quality parameters, including pH, conductivity, and dissolved oxygen, all of which were measured with Environmental Protection Agency approved electronic monitoring equipment. In order to make accurate observations and comparisons of biological indicator organisms and chemical water quality analysis, three pristine control streams (Beaver Creek West, Sucker Brook, and Robbs Creek) were chosen far from human development and impact. The study concluded that 37 sample sites had excellent Biotic Index values, 7 sample sites had good BI values, 4 sample sites had fair BI values, and 2 sample sites had poor BI values. The study also concluded that 16 sample sites had excellent Percent Model Affinity values, 18 sample sites had good PMA values, 9 sample sites had fair PMA values, and 7 sample sites had poor PMA values. In most cases, mayflies, stoneflies, or caddisflies were the dominant species, indicating overall excellent water quality. A comparison of known chemical water quality standards to sample benthic macroinvertebrates revealed that water quality can be accurately evaluated by analyzing the composition, number, and taxonomic order of benthic macroinvertebrates.

## ***Why We Need Nature***

Nature is the stage upon which the drama of human life unfolds. When unsustainable human activities supersede nature's tipping point, what are the consequences? Easter Island is a clear example where the environment lost its ability to recover, resulting in the near annihilation of its inhabitants. The degree to which humans destroyed the Island's ecology is startling. Easter Island, in microcosm, is Earth. Nature does strike back, as the people of Easter Island learned. Resource depletion and desertification led to warfare, starvation, cannibalism, and ultimately the complete collapse of their culture. This presentation will explore Easter Islanders mistakes against nature as they are relevant to the same mistakes we are making today on planet earth. The stakes are larger, but the same basic environmental issues of overpopulation, water resource degradation,

deforestation, and species extinction remain. In a world where pollution permeates the Arctic and deserts grow in the tropics, listening to nature may prove to be a lesson of necessity for all humankind.