How do we quantify relationships between biodiversity, ecological processes, and ecosystem services?

How do we enhance and facilitate ecosystem service delivery in managed ecosystems?

Catherine Lindell, Associate Professor and Graduate Program Director, 75% Zoology Dept. (soon to be Dept. of Integrative Biology), 25% CGCEO.
Limiting bird damage in fruit crops: integrating economic, biological, and consumer information to determine testable management strategies for the future

Funded by the Specialty Crop Research Initiative of the United State Department of Agriculture
Consumer Response

Field management

Economics

Bird Management
Institutions

Pacific Northwest
Trinity Western University, Oregon State University, Washington State University

New York
Cornell University

Colorado
USDA-APHIS: National Wildlife Research Center

Michigan
Michigan State University Center for Global Change and Earth Observations
Early-ripening varieties have more bird activity and damage

Yellow triangles = cedar waxwings, Gray circles = American robins, NWMHRS sweet cherries, Summer 2013
Inflatables, Air dancers, Air rangers
Sweet cherry dancer trial, 2014
Seven sites with one or two dancers
The Economic Impact of Bird Damage to Blueberries

Funding provided by USDA’s Specialty Crop Research Initiative Summer 2014

Bird damage is a persistent problem faced by fruit growers. The economic impact of bird damage and the value of bird management are poorly understood, particularly for fruit crops. In 2012, funding was provided by USDA’s Specialty Crop Research Initiative to perform an interdisciplinary research study of bird damage to ‘Honeycrisp’ apples, wine grapes, blueberries, and tart and sweet cherries in five states: California, Michigan, New York, Oregon, and Washington.

Objectives of the economic analysis of bird damage were to:
• Survey fruit growers to assess current bird damage levels and the effectiveness of their management techniques.
• Calculate the monetary value of the crop lost to birds and the benefits of management.
• Estimate the economic impact of bird damage to the regional economy in each state in terms of changes in output and employment.

Fruit growers estimated their 1) yield loss in 2011, 2) yield loss if they did not use any bird management techniques, and 3) yield loss if they and their neighbors did not use bird management. These estimates were used to calculate the value of crops lost to birds, and a low and high estimate of the economic benefits of current bird management. Additionally, impacts to the broader economy from damage to crops and the savings associated with bird management were estimated using a model of the regional economy that predicts how a change in one industry can affect revenue and employment throughout the economy. These results illustrate how crop loss affects the region’s economy.

Table 1. Annual impact of bird damage to blueberries and economic benefits of bird management.

<table>
<thead>
<tr>
<th></th>
<th>California</th>
<th>Michigan</th>
<th>New York</th>
<th>Oregon</th>
<th>Washington</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Damage</td>
<td>-$2,649,875</td>
<td>-$14,052,402</td>
<td>-$585,753</td>
<td>-$11,238,095</td>
<td>-$4,653,105</td>
</tr>
<tr>
<td>Benefit (low estimate)</td>
<td>$44,768,942</td>
<td>$33,056,603</td>
<td>$2,022,598</td>
<td>$11,114,599</td>
<td>$16,837,524</td>
</tr>
<tr>
<td>Benefit (high estimate)</td>
<td>$47,349,084</td>
<td>$40,149,721</td>
<td>$2,137,747</td>
<td>$11,114,600</td>
<td>$20,867,017</td>
</tr>
</tbody>
</table>
Monitoring Boxes
Predator nest boxes
Example Video Recording:
Female Kestrel Delivering Vole
Figure 4. Relative proportions of different prey types delivered to each box in 2014 between 9:00 and 17:00 during two randomly chosen recording days. Numbers within bars indicate total number of deliveries per box. Numbers above bars indicate total number of recording hours included per box.
Estimated pest removals by 16 kestrel pairs using boxes in northern Michigan orchards

<table>
<thead>
<tr>
<th>Insects</th>
<th>Mammals</th>
<th>Birds</th>
</tr>
</thead>
<tbody>
<tr>
<td>29,888</td>
<td>1,136</td>
<td>768</td>
</tr>
</tbody>
</table>

Extrapolated from diet study of 8 kestrel boxes in 2013 in Leelanau County, MI
Willingness to pay amounts for attributes compared to reference fruit (i.e. bird management practice of live ammunition, and geographic origin that is non-local), with standard errors in parentheses.
Raptor Poles and Nesting Boxes in Lange Estate Vineyard

If you look closely, you might see some new additions to our vineyard the next time you visit. We’ve been working closely with the Yamhill Soil & Water Conservation District on an exciting new project!

Recently, the Yamhill SWCD received grant funding from the Oregon Watershed Enhancement Board to assist landowners with installing raptors poles and nesting boxes on their property. The SWCD is repurposing old hop poles from 4B Farms in Mt. Angel, Oregon to make the raptor poles and their team of expert volunteers are making high quality (and heavy!) nesting boxes for the project. The program participants will be putting up the boxes and poles this spring and summer.

Michael Crabtree, a Conservation Technician at the Yamhill Soil and Water Conservation District says, “The Yamhill SWCD is working with landowners such as the Lange family to increase the amount of functioning wildlife habitat in the county. This project will benefit Raptor species such as the American Kestrel.”
In the Community
Update on our Community Projects

Homes for Kestrels

Several years ago Tacie and I noticed that we had kestrels patrolling the vineyard near our house. These birds are also known as sparrow hawks, but are actually small falcons. We were thrilled to observe that when these beautiful little raptors were around, all of the birds that like to eat our ripening grapes made a hasty retreat from the vineyard. After years of using propane cannons, synthetic noise makers, balloons and aluminum foil we found that we had the best bird control Mother Nature could provide. We now have two pairs of kestrels nesting near our vineyard and have put up nesting boxes to encourage others to make their home at King Ferry Vineyards. Our neighbors hated all of the noise makers and are as excited as we are to have these wonderful new additions to the community.
For more information:
http://birddamagetofruitcrops.info/

Limiting bird damage to fruit crops:
- integrating economic, biological, & consumer information to determine testable management strategies for the future

Fruit producers have identified bird damage as a critical issue that has received limited attention from researchers. A USDA study estimated that birds cost producers in seven states tens of millions of dollars through fruit loss and management efforts. Despite these costs, research has been uncoordinated and piecemeal, leaving producers with few affordable management options. Our transdisciplinary, multi-state team will address bird damage to blueberries, cherries, wine grapes, and “Honeycrisp” apples with a systems approach. Our long-term goal is to provide producers with cost-effective, environmentally sustainable bird management strategies.
Deforestation of tropical lands


FAO 2005
Welcome!

**PARTNERS** brings natural and social scientists together to address the complexity of socio-ecological processes that shape tropical reforestation. We are anthropologists, economists, forest ecologists, foresters, geographers, landscape ecologists, political scientists, and sociologists from around the world who share a deep interest in forest regrowth in the tropics. We consider reforestation in a broad sense, encompassing natural regeneration, silvopastoral and agroforestry systems, ecological restoration plantings, commercial tree plantations, and smallholder plantations.

The 20th century was a period of unprecedented deforestation in the world’s tropical regions. Deforestation rates are now slowly declining due to increasing rates of reforestation, spontaneous natural forest regeneration, changing forest conservation and management policies, and rural to urban migration.

New types of forest cover are emerging from a complex interaction between land-use histories, landscape features, climate variability, and socio-economic factors that operate from local to global scales.

**PARTNERS** will synthesize existing knowledge, identify knowledge gaps, identify new directions for interdisciplinary research, and prepare peer-reviewed documents for educators and policy makers. [More...]

**PARTNERS** is a Research Coordination Network funded by the U. S. National Science Foundation, Coupled Natural and Human Systems Program
Other Resources

Wet laboratory in Natural Science Building

Large network of fruit growers in U.S.

Tropical forest restoration network

Field experience with biodiversity sampling, quantification of ecological processes.