

# NASA LCLUC: Modeling Siberian Boreal Forest Land-Cover Change and Carbon Under Changing Economic Paradigms

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## What are the Regional Forest and Land-Cover Dynamics?

### LOGGING

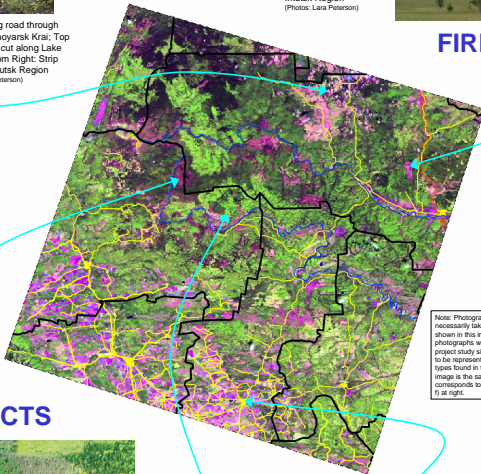


Left: Logging road through Taiga, Krasnoyarsk Krai; Top Right: Clear cut along Lake Baikal, Bottom Right: Strip cutting in Irkutsk Region (Photos: Lara Peterson)

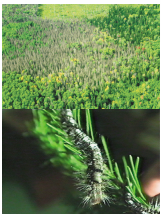


Left: Active fire (Photo: Amber Soja/Herman Shugart); Top Right: Base of burned slash; Center Right: Burn scar from current year's fire; Bottom: Old fire scar, Irkutsk Region (Photos: Lara Peterson)

### FIRE



### INSECTS



Forest stand damage resulting from Siberian silkworm (*Dendrolimus sibiricus*) in Krasnoyarsk Krai (Photo: ESWG Project)

### PEOPLE



Recreation

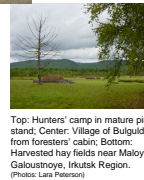
Settlements

### REGROWTH



Left: Regrowth is *Populus tremula*, Krasnoyarsk Krai (Photo: Vyacheslav Kharuk); Center: Deciduous regeneration after logging in *Pinus sylvestris* stand, Irkutsk Region; Right: Mixed regeneration following clearcut, Irkutsk region (Photos: Lara Peterson)

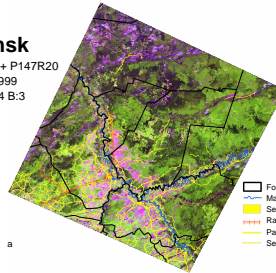
Agriculture



Top: Hunters' camp in mature pine stand; Center: Village of Bulguidinka from foresters' cabin; Bottom: Harvested fields near Maloye Galoustnoye, Irkutsk Region. (Photos: Lara Peterson)

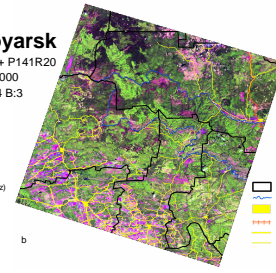
## Where? Three Case Study Sites in Tomsk Oblast, Krasnoyarsk Krai, Irkutsk Oblast

**Tomsk**  
Landsat ETM+ P147R20  
7/9/1999  
R:5 G:4 B:3



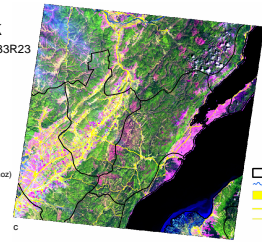
Forest Management Units (Leskhöz)  
Major Rivers  
Settlements  
Railroads  
Paved Roads  
Secondary Roads

**Krasnoyarsk**  
Landsat ETM+ P141R20  
8/19/2000  
R:5 G:4 B:3



Forest Management Units (Leskhöz)  
Major Rivers  
Settlements  
Railroads  
Paved Roads  
Secondary Roads

**Irkutsk**  
Landsat ETM+ P133R23  
8/13/2001  
R:5 G:4 B:3

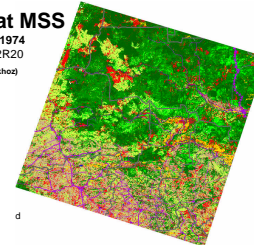


Forest Management Units (Leskhöz)  
Major Rivers  
Settlements  
Paved Roads  
Secondary Roads

Sources: Forest Management Unit (Leskhöz) boundaries are from Stolbova V. and I. Moskatova, 2002. CD-ROM Land Resources of Russia, International Institute for Applied Systems Analysis and the Russian Academy of Sciences. Major Rivers, Railroads, Paved Roads, and Secondary Roads are from the Ministry of Natural Resources, Irkutsk, Krasnoyarsk Krai, Tomsk Oblast, Krasnoyarsk Krai, and Irkutsk Oblast.

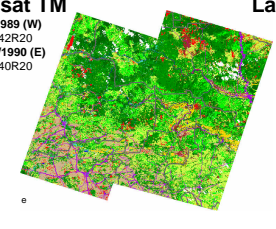
## What Kind and How Much LCLUC? Krasnoyarsk Krai Case Study Site 1974-2000

**Landsat MSS**  
6/26/1974  
P152R20

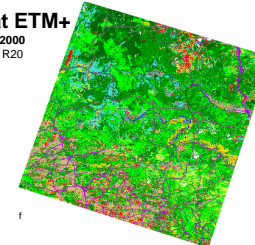


Legend  
Forest Management Units (Leskhöz)  
Railroads  
Paved Roads  
Secondary Roads  
Land Cover Type  
Agriculture  
Coniferous Forest  
Deciduous Forest  
Fire Scar  
Fresh Cud Bare Ground  
Insect Damage  
Mixed Forest  
Regeneration  
Settlements  
Water  
Wetlands  
Clouds/Shadows (no data)

**Landsat TM**  
7/2/1989 (W)  
P142R20 & 7177/990 (E)  
P140R20



**Landsat ETM+**  
8/18/2000  
P141R20

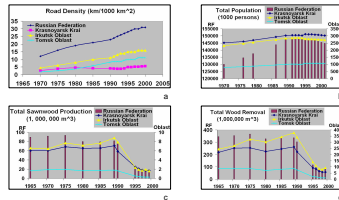


### Classification Procedures:

Supervised classifications were performed using Erdas Imagine 8.5. The second-level classification scheme (see legend) used in this project represents land cover types distinguishable from the data in all case study sites and time periods. Training sites were generated using ancillary data provided by the Sukachev Forest Institute, Krasnoyarsk, Russia. Initial classified images for each date were used to mask out urban and wetland features that have not changed significantly over the study period. Agricultural areas were then masked out using secondary classifications of each image, and the resulting images were reclassified. Masked out features (agriculture, wetlands, and settlements) were rejoin with the final classification results to create the final maps shown here.

\*Sources used by the Sukachev Institute include Federal Geostandart and Cartography Service of Russia, 1993. Topographic Maps of the Region, scale 1:200,000. Forest Inventory Maps of Matured Forests, 1982. Atlas of USSR Forests, scale 1:3,000,000, 1973. Forest Map of the USSR, scale 1:3,000,000, 1990, and land acquisition data (not in Russian).

## What Types of Models? Forest Dynamics and Socio-Economic

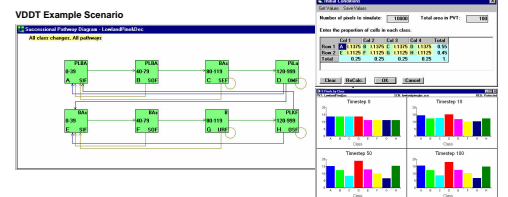


### Vegetation Dynamics Development Tool (VDDT)\*

Left: Preliminary Successional Pathway Diagram for the Lowland Pine and Deciduous Forest type in the Irkutsk study site. Each box (A-H) represents a successional class defined by potential vegetation type (e.g. PLBA is dominated by *Pinus sibirica* and *Larix sibirica* with birch and aspen as secondary species), age class (e.g. 0-30), and structural stage (e.g. SIF = stand initiation phase). Arrows show succession (green) and various disturbance (other) pathways. Top right: Initial conditions, including plot number, percentage by class, and management type can be modified prior to running the model. Bottom right: Sample results from running this scenario, showing percentage of pixels by class after 0, 10, 50, and 100 years.

\*Vegetation Dynamics Development Tool, version 4.0, July 23, 2000. ESSA Technologies Ltd. This tool explores the effects that landscape-scale disturbances under varying management scenarios have on vegetation. Potential cover types have been modified to fit the relevant Siberian ecosystem.

Scenario: The 1991 data (a) and (b) are from the Russian Statistical Annual, 1994, Government of Russia. Post-1991 data (c) and (d) are from Regions of Russia, 2002, Government of Russia. Pre-1991 data for (c) and (d) are from Forest Cover of USSR, 1991, Ministry of Natural Resources, Research Institute of Economics, Post-1991 data for (c) and (d) are from Industry of Russia, Government of Russia.



## How will the Landsat Change Mapping and Models be Integrated?

