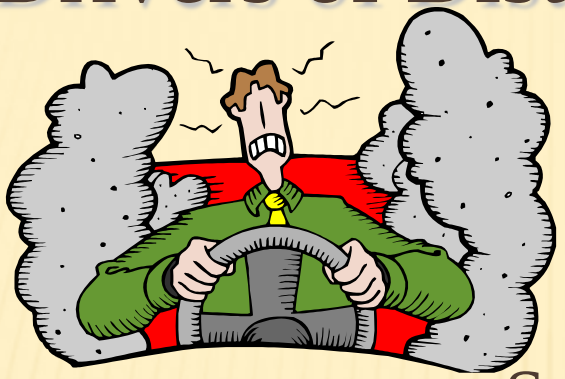
THE NASA LAND-COVER/LAND-USE CHANGE (LCLUC) PROGRAM: FOCUS ON CENTRAL ASIA

Garik Gutman,
LCLUC Program Manager
NASA Headquarters
Washington, DC

LCLUC: Drivers of Disturbance/Stress



- Natural Drivers
  - Natural hazards (fires, droughts, floods, hurricanes, landslides)
  - Invasive species
  - Climate
- Anthropogenic Drivers
  - Agricultural changes
  - Landscape modification, e.g. urbanization
  - Forest clearing, logging & fires
  - Grazing by domestic animals
- Socio-Economic Drivers
  - Technological change and macro-economic transformations
  - Political economy and institutional change
  - Values, attitudes, beliefs, individual and household behavior
  - Human population dynamics

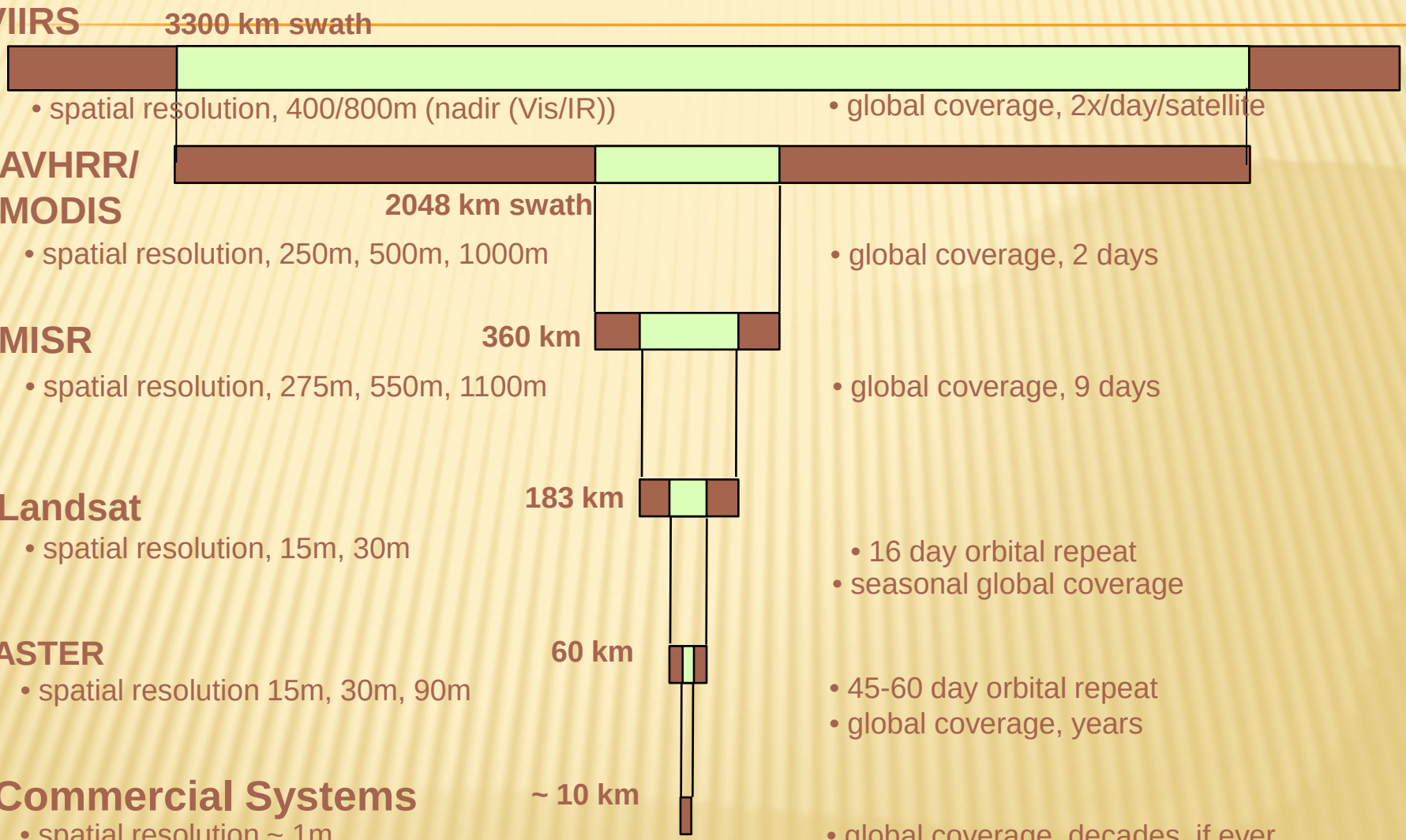
LCLUC Consequences/Impacts

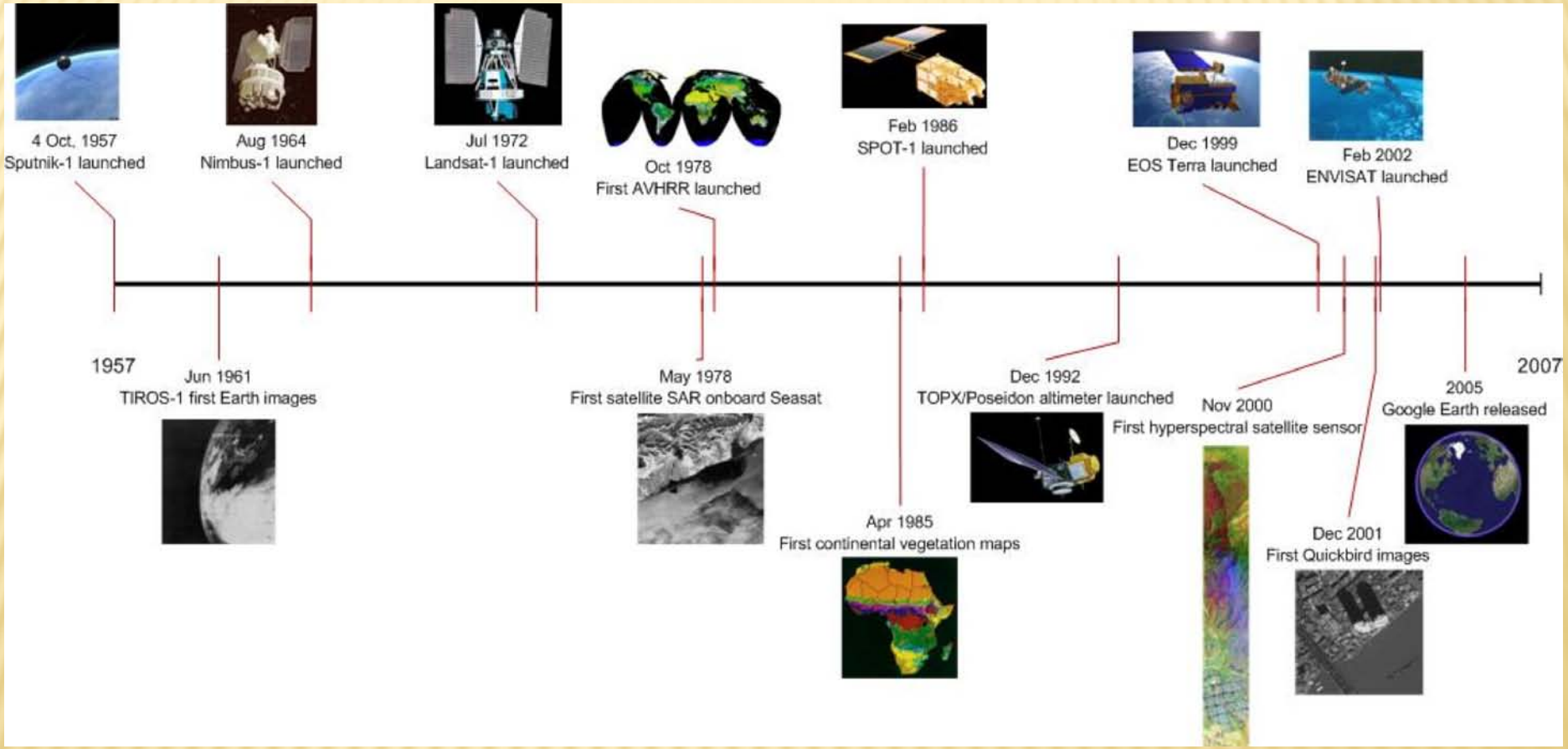
- Forestry
- Agriculture
- Wetlands and coastal zone
- High Elevations
- Water resources and their quality
- Carbon storage and release
- Habitat degradation and fragmentation
- Atmospheric processes

TOOLS

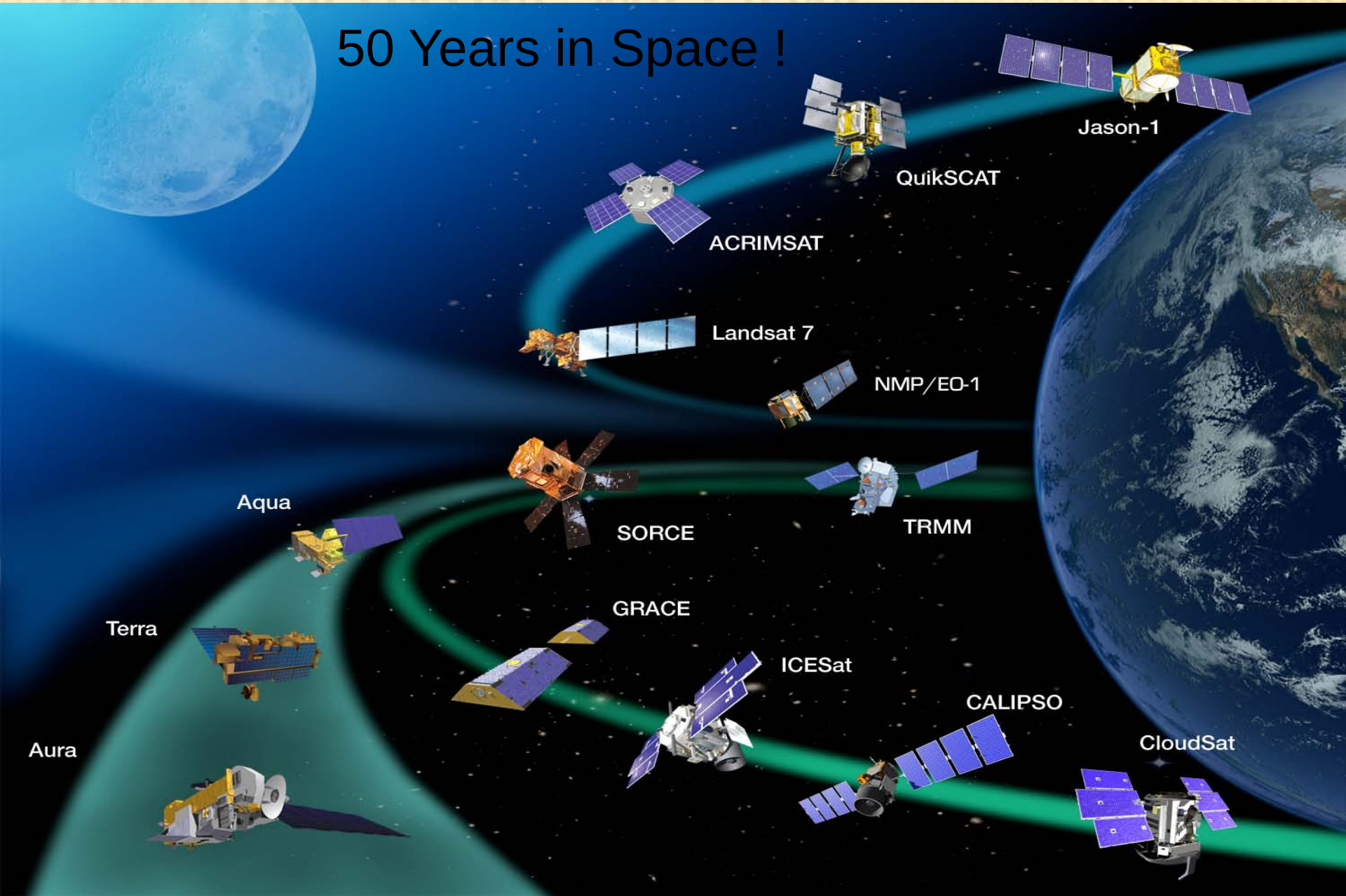
- Remote sensing observations (satellite and airborne)
  - Optical
    - Hyper-spatial resolution multispectral (e.g. IKONOS, Orbview)
    - High resolution multispectral (e.g. Landsat, SPOT)
    - Moderate resolution multispectral (e.g. AVHRR, MODIS, MERIS)
    - Lidars
  - Microwave
    - Passive
    - Radars
- In situ observations and intensive field campaigns
- Modeling and integrative data analysis
- Data and information systems

Synergistic Use of Optical Remote Sensing



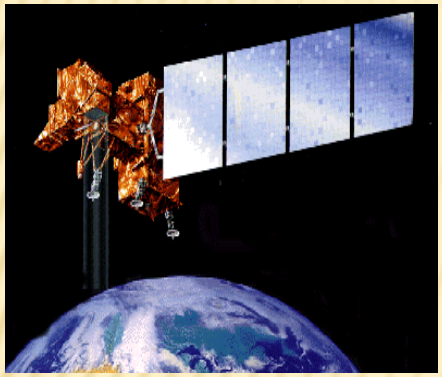

4 Oct. 1957
Sputnik-1 launched
Aug 1964
Nimbus-1 launched
Jul 1972
Landsat-1 launched
Oct 1978
First AVHRR launched
Feb 1986
SPOT-1 launched
Dec 1999
EOS Terra launched
Feb 2002
ENVISAT launched
1957
Jun 1961
TIROS-1 first Earth images
May 1978
First satellite SAR onboard Seasat
Dec 1992
TOPX/Poseidon altimeter launched
Nov 2000
First hyperspectral satellite sensor
2005
Google Earth released
2007
Apr 1985
First continental vegetation maps
Dec 2001
First Quickbird images

NASA OPERATING MISSIONS

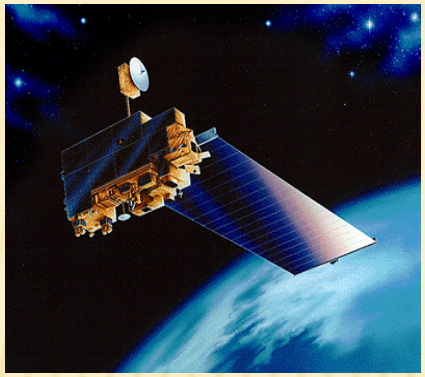


NASA LCLUC-relevant Missions

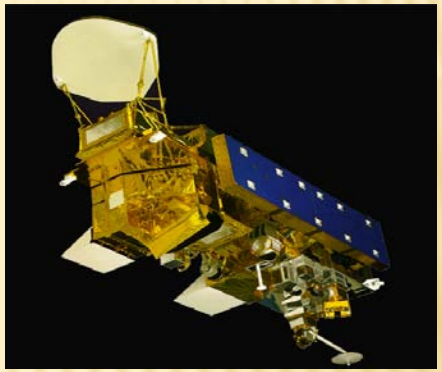
Systematic Missions - Observation of Key Earth System Interactions



Landsat 7
4/15/99



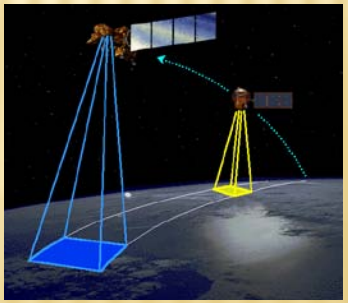
Terra
12/18/99



Aqua
5/3/02

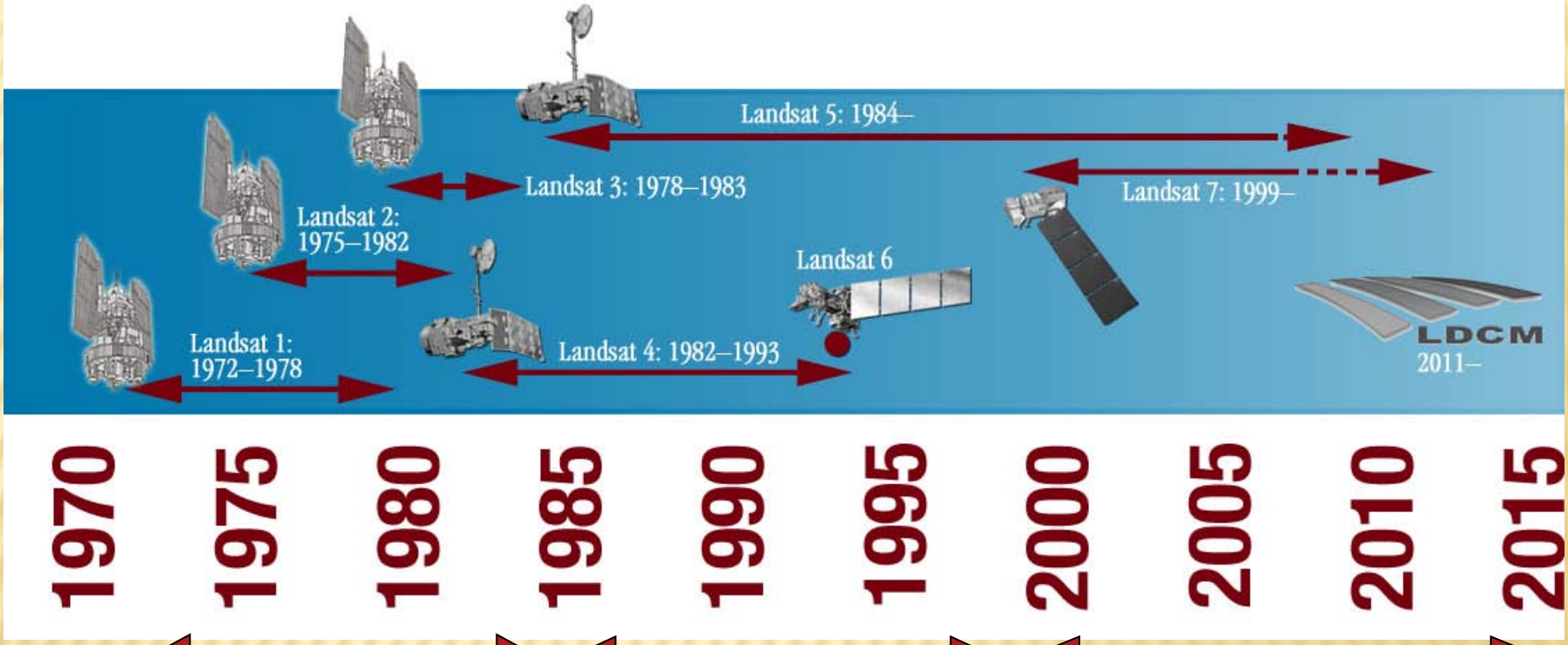
Exploratory Missions - Exploration of Specific Earth System Processes and Parameters and Demonstration of Technologies

SRTM
2/11/00



EO-1
11/21/00

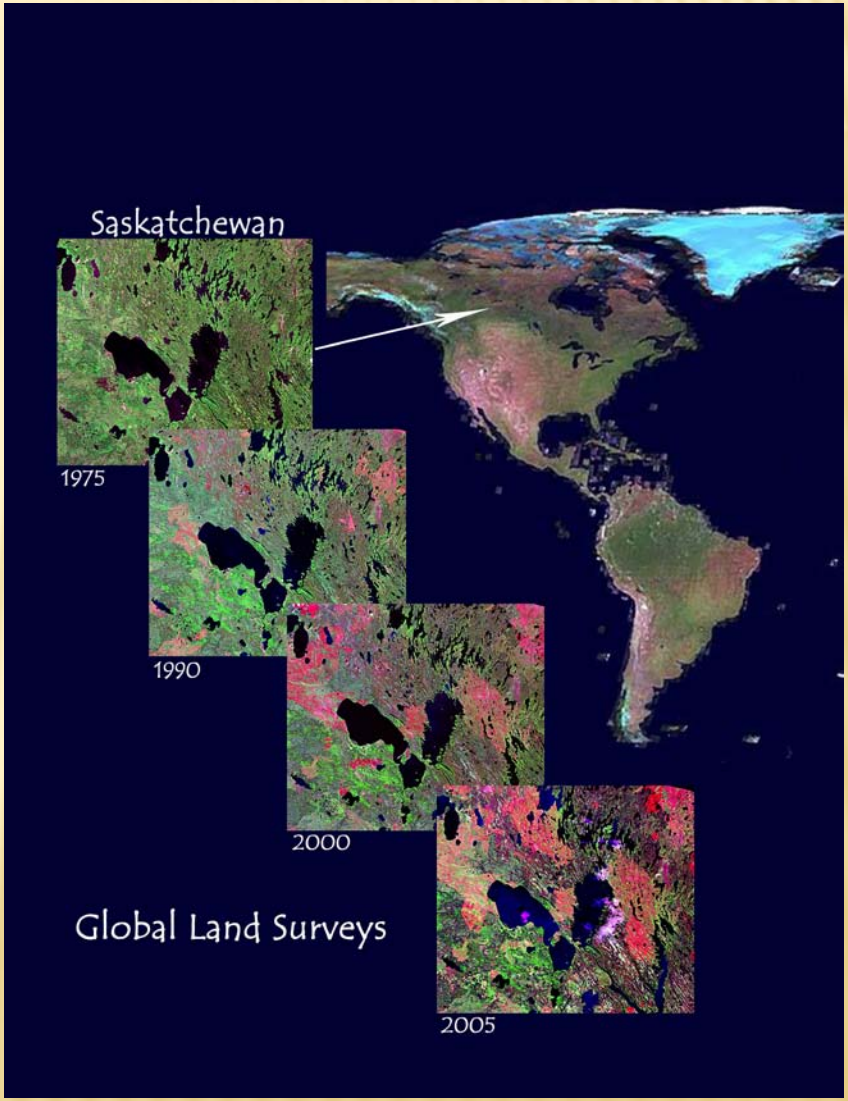
HISTORY OF THE LANDSAT PROGRAM



Global Land Survey Data Sets

Global cloud-free, 30-m orthorectified Landsat-based data sets centered on 1975, 1990, 2000, 2005, and 2010

- In partnership between USGS and NASA
- Support global assessments of land-cover, land-cover change, and ecosystem dynamics (disturbance, vegetation health, etc.)
- GLS-2005 completed and freely available
- GLS-2010 being collected



2-Programs Synergy

NEESPI-MAIRS Overlap

ISSUES IN THE CENTRAL ASIA ARID ZONE

- Soil and environmental degradation
  - accelerated erosion
  - salinization
  - depletion of soil organic carbon pool
- Conversion of natural and extensively used systems to agricultural ecosystems
  - Mineralization
  - depletion of the Soil Organic Carbon pool
  - emission of CO2 from soil to the atmosphere
- Soil degradation => pollution, eutrophication and depletion of water resources of the region
- Shrinkage of the Aral Sea is just one of the examples of the serious problems with the water resources
  - Overuse of two major rivers feeding the Aral Sea for irrigation purposes
  - Lack of water for sustainability in the region


2000

CHANGES FROM 1960 TO 1996

- water level dropped by 17 m
- water volume down by 70 %
- aquatic surface reduced from 67,000 to 30,000 Km^2
- water inflow dropped from 60 km^3/yr to 5-10 km^3/yr
- Earlier number of species: 500 for birds, 200 for mammals
- Now: only 38 species of wild animals

Social Changes

- Population migration
- Health damage
- Reduction of the length of the human life
- Worsening of the living conditions

NASA PAST LCLUC NEESPI/MAIRS DRYLAND PROJECTS

Vladimir Aizen, University of Idaho
Glacial Area Changes in Central Asia & LCLUC

Charles Vorosmarty, University of New Hampshire
Role of LCLUC in Water Budget and Water Use Across Central Asia

Jeff Henebry, South Dakota State University
Assessing the vulnerability of the Eurasian semi-arid grain belt

Roland Geerken, Yale University
Ecological Monitoring in Semi-Arid Central Asia.)

Jiquan Chen, University of Toledo, Ohio
Effects of Land-Use Change on the Energy and Water Balance of the Semi-Arid Region of Inner Mongolia (PI:

Marc Imhoff, NASA GSFC
Linking Biophysics and Socio-economics for Addressing Water Vulnerability in Central Asia Regions

Xubin Zeng, University of Arizona
Relationship between Land Cover/Land Use Change and Surface Hydrology over Arid and Semiarid

Irina Sokolik, Georgia Technological Institute
LCLUC-atmospheric dust interactions

Dennis Ojima, Colorado State University
C-land Use-Climate Interaction in the Semi-Arid Regions

RECENT NASA LCLUC NEESPI/MAIRS DRYLANDS PROJECTS

Vladimir Aizen, University of Idaho

- **Changes in alpine water storages and land surface degradation in Pamir mountains and Amu Dariya River basin**

Alex Shiklomanov, University of New Hampshire

- **Northern Eurasian Landscapes: Interactions between Humans, Hydrology, Land Cover and Land Use**

Jiquan Chen, University of Toledo, Ohio

- **Interactive Changes of Ecosystems and Societies on the Mongolian Plateau: From Coupled Regulations of Land Use and Changing Climate to Adaptation**

Dan Brown, University of Michigan

- **Grassland Ecosystems and Societal Adaptations Under Changing Grazing Intensity and Climate on the Mongolian Plateau**

Kirsten de Beurs, Virginia Polytechnical Institute

- **Land Abandonment in Russia: Assessing Future Vulnerability and Adaptation to Changing Climate and Population Dynamics**

Sassan Saatchi, UCLA/JPL

- **Impacts of Land Cover and Land Use Change on Water and Energy Cycle in Caspian Sea Drainage Basin**

Peilei Fan, Michigan State University

- **China's urbanization and its sustainability under future climate change**

Mutlu Ozdogan, University of Wisconsin

- **Investigating the Relationship Between Land Use/Land Cover Change, Hydrologic Cycle, and Climate in Semi-Arid Central Asia**

http://lcluc.hq.nasa.gov/

LCLUC BOOK

REMOTE SENSING AND DIGITAL IMAGE PROCESSING

Land Change Science

Observing, Monitoring and Understanding Trajectories of Change on the Earth's Surface

Edited by
Garik Gutman, Anthony C. Janetos, Christopher O. Justice,
Emilio F. Moran, John F. Mustard, Ronald R. Rindfuss, David Skole,
Billy Lee Turner II and Mark A. Cochrane

This volume is a synthesis of the NASA funded work under the Land-Cover and Land-Use Change Program. Hundreds of scientists have worked for the past 8 years to understand one of the most important forces that is changing our planet - human impacts on land cover, that is land use. Its contributions span the natural and the social sciences, and apply state-of-the-art techniques for understanding the Earth: satellite remote sensing, geographic information systems, modeling, and advanced computing. It brings together detailed case studies, regional analyses, and globally scaled mapping efforts. This is the most organized effort made to understand the dominant force that has been responsible for changing the Earth's biosphere.

Audience
This publication will be of interest to students, scientists, and policy makers.

CD-ROM included
This volume includes a CD-ROM containing full color images of a selection of illustrations which are printed in black-and-white in the book.

ISBN 1-4020-2561-0
9 781402 025617

KLUWER ACADEMIC PUBLISHERS RDIP 6

Land Change Science

Gutman, Janetos, Justice, Moran, Mustard, Rindfuss, Skole, Turner II and Cochrane (Eds.)

REMOTE SENSING AND DIGITAL IMAGE PROCESSING

Land Change Science

Observing, Monitoring and Understanding Trajectories of Change on the Earth's Surface

Edited by
Garik Gutman,
Anthony C. Janetos,
Christopher O. Justice,
Emilio F. Moran,
John F. Mustard,
Ronald R. Rindfuss,
David Skole,
Billy Lee Turner II and
Mark A. Cochrane

Kluwer Academic Publishers

CD-ROM INCLUDED

谢谢

спасибо

Thank you!