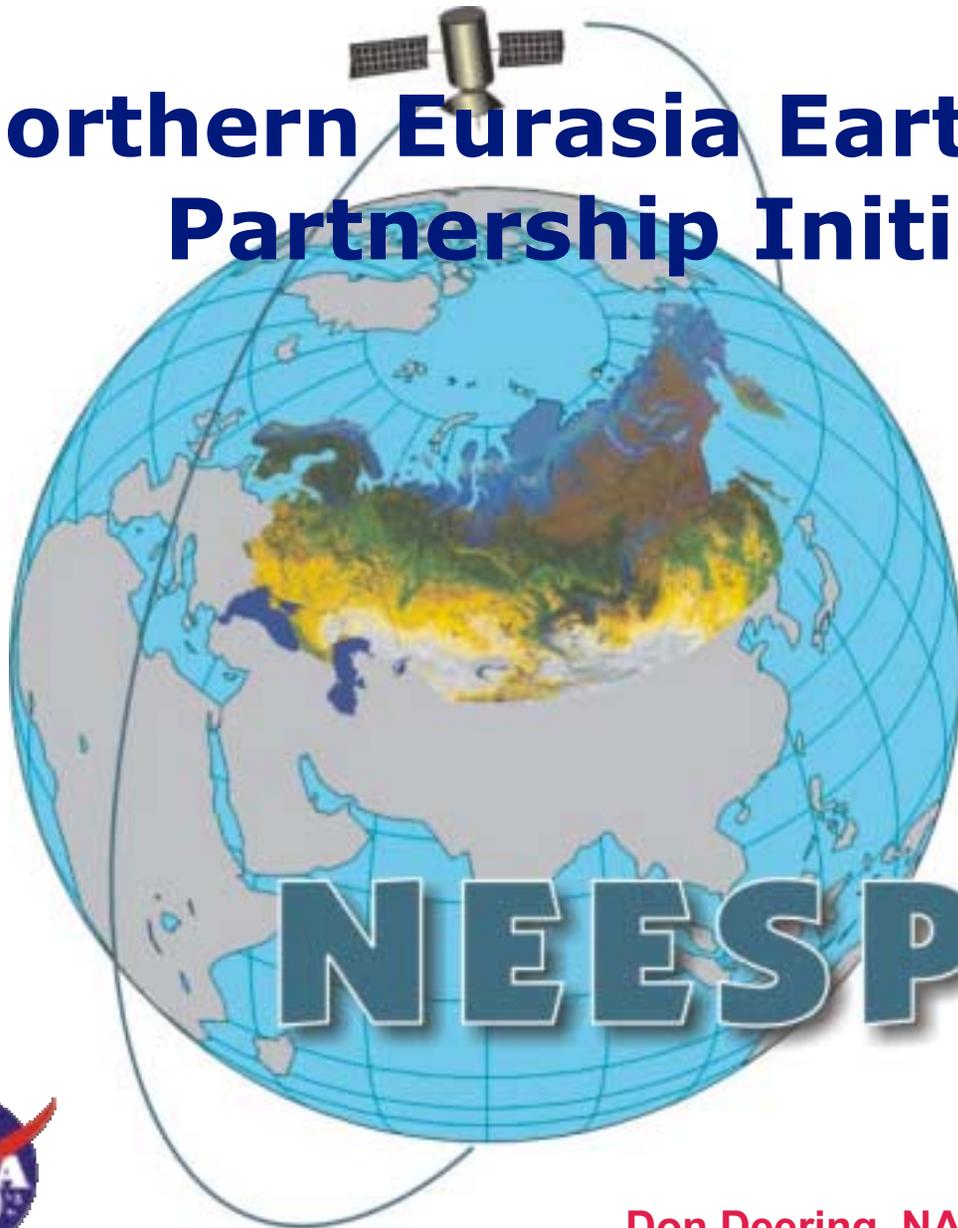


<http://neespi.gsfc.nasa.gov>

Northern Eurasia Earth Science Partnership Initiative



**Update for
NASA HQ
Program
Management**

--

Site Visit to GSFC
March 17,
2004



Don Deering, NASA-NEESPI Project Manager



What is the NEESPI?

- The Northern Eurasia Earth Science Partnership Initiative, or NEESPI is
- a currently active, *and*
- a *strategically evolving* program of internationally-supported Earth systems science research,
- which has as its foci issues in northern Eurasia that are currently relevant to regional and Global scientific and decision-making communities.



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Why Northern Eurasia?

- **The changes in this region have the potential to affect the entire Earth System and may already be doing so.**
- **The region has unique features that need to be better understood, parameterized, and accounted for. Without clear understanding of them, the description and modeling of the entire Earth system are not possible.**
- **Results from the study will have benefits to the societies of the region as well as to the global community.**



Unique features of Northern Eurasia

- **The world's largest cold region.** Two thirds of the global permafrost, two thirds of the globe with seasonal snow cover, etc.
- **More than half of terrestrial carbon**
- **World largest forest**
- **The most continental climate.** It controls the intensity of the Eurasian monsoon.
- **Cut off from the humid tropics** → the highest levels of climate and weather variability and highly vulnerable natural and agricultural ecosystems.
- **Extensive variable dry land areas** → the largest source of dust in the extratropics.



North America and Northern Eurasia Complement Each Other Rather Than Express Redundancies. Key factors:

- **Size of the Eurasian continent**
- **Isolation of Northern Eurasia from the tropics**
- **The geographical differences have produced**
 - **(a) unique ecosystems with different reactions to external forcing and different history and**
 - **(b) unique combinations of atmospheric circulation conditions and controls**
- **State and synergy of all the above have generated and will generate in the future different feedbacks and patterns of environmental changes.**



Some Areas of Concern Regarding Changes in Northern Eurasia for the Global Earth System

- **Terrestrial carbon pool**
- **Accelerated climatic changes**
- **Changes in surface albedo**
- **Permafrost**
- **Bogs**
- **Fresh water transport to the Arctic**
- **Erosion in the coastal zone**
- **Aridization and aeolian aerosol input**
- **Human activity**



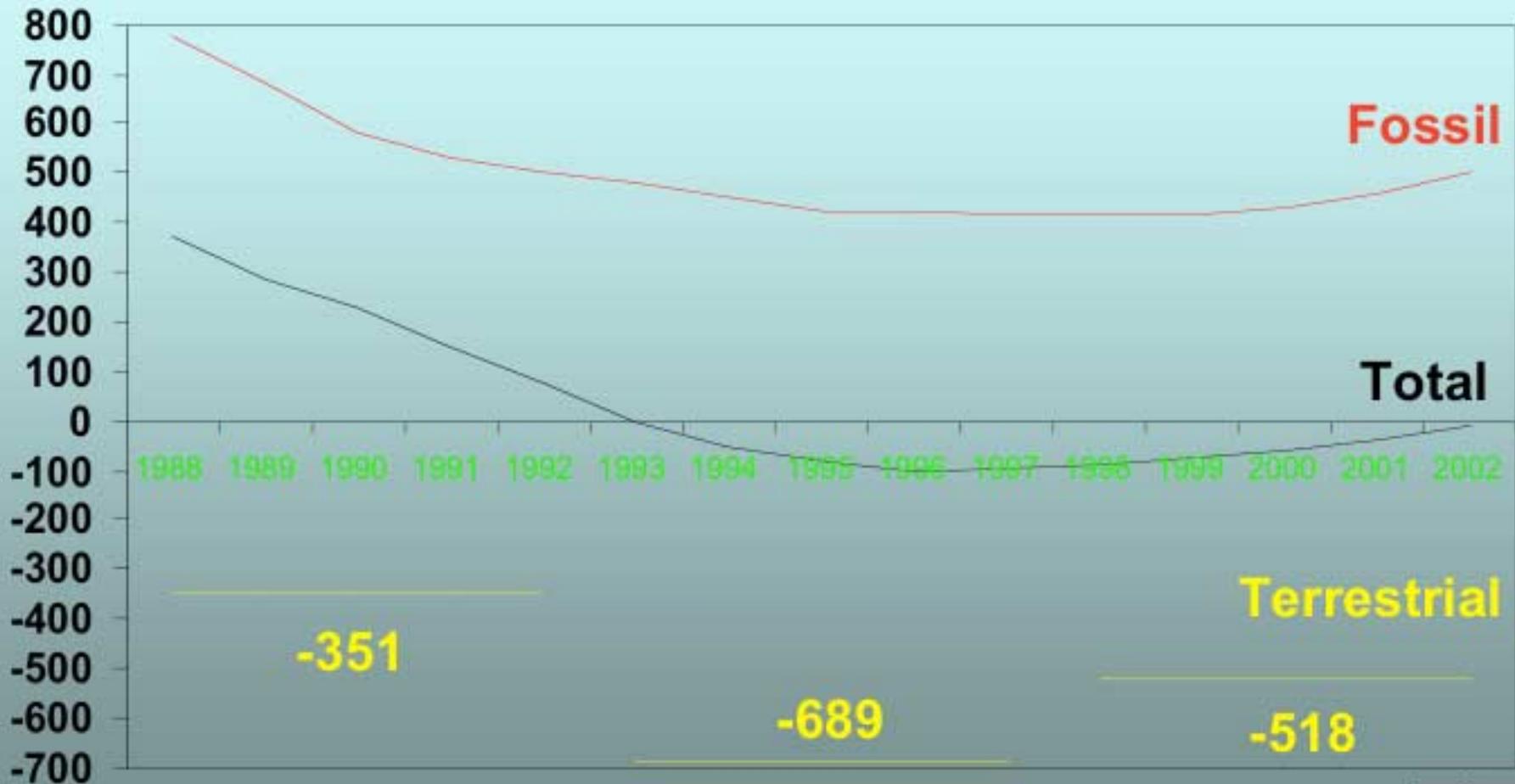
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Trends in Total C-CO₂ (TgC) Emissions in Russia 1988–2002

TgC



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Permafrost



- In Northern Eurasia permafrost formation occupies an area greater than **10 million sq. km**
- In the European part, permafrost occurs only in the tundra and the forest-tundra zone.
- In Siberia and Far East to the east of the Enisei the permafrost occurs almost everywhere, except for south Kamchatka, Sakhalin Island, and Primorjje



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2/3 of permafrost is in Northern Eurasia
Two probable scenarios after permafrost thaw:

Wetlands
-- no forests



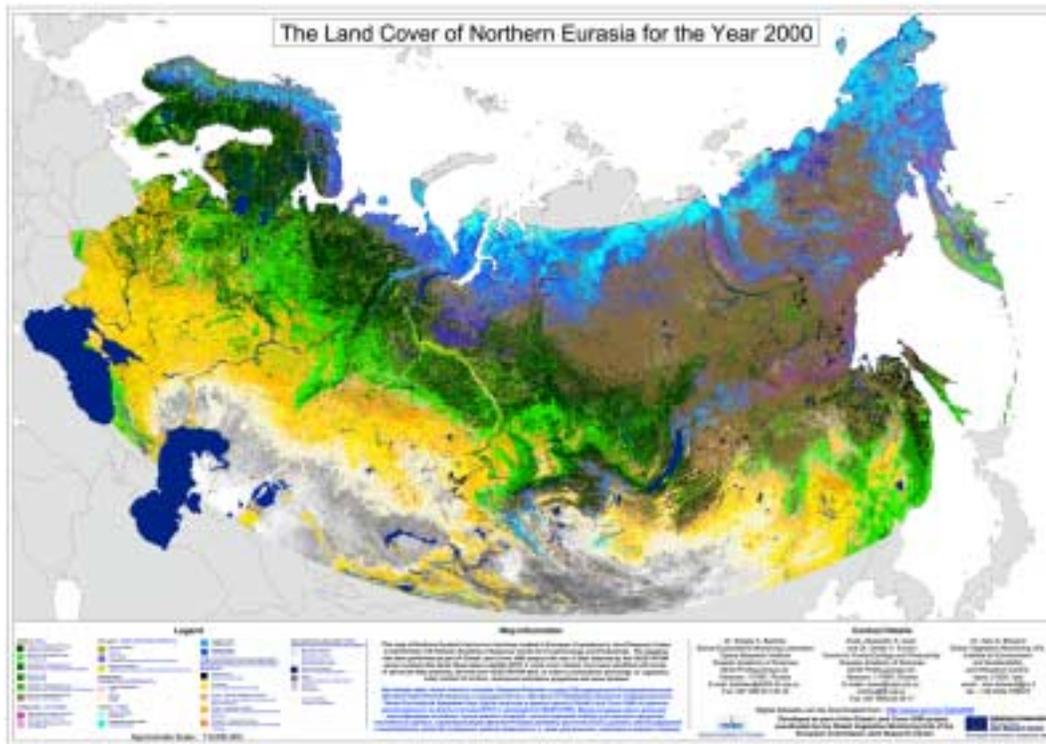
Steppe
-- no forests



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Human Activity via Land-Use change: Some Examples of Recent History with Potential Impacts



- conversion of steppe ecosystems to agriculture in South-Western Siberia and Kazakhstan
- extensive logging of taiga forests in the European North of Russia
- drying-out of wetlands mainly for peat extraction and agriculture

The environmental changes during last century are not well documented and quantified



Biogeochemical Cycles in Northern Eurasia



Average areas of natural disturbances in Northern Eurasia during the period 1998-2003 *increased at about 3 times*



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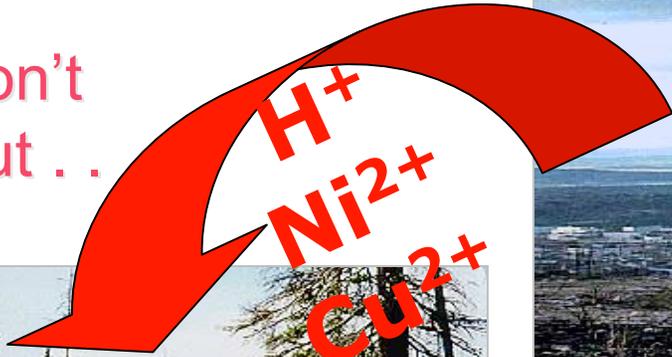
Biogeochemical Cycles

Why is it *globally* important?

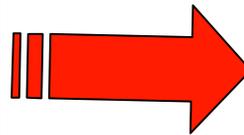
- Huge scale: 14% of the global organic terrestrial carbon, 25% of the world forests
- **Dramatic climate changes are expected**
- High probability that natural disturbances will become more frequent (fire, insect outbreaks)
- **Degradation of permafrost will be widespread**
- Possibilities for substantial carbon sequestration
- Societal and economic institutions are undergoing transition, and it is not clear whether they will stabilize.



... and don't forget about ...



Atmospheric Pollution!



Major Uncertainties in Northern Eurasia

- During the past, we have witnessed significant changes in climate, hydrosphere, cryosphere, and land cover in Northern Eurasia but cannot accurately attribute these changes to a particular process (processes) that caused them.
- Taking into account the scale and rate of changes, **this situation is unacceptable when we need to model the processes that will provide for needed future projections of climatic and environmental changes and their impacts on society.**



Some Overarching Science Questions for Northern Eurasia

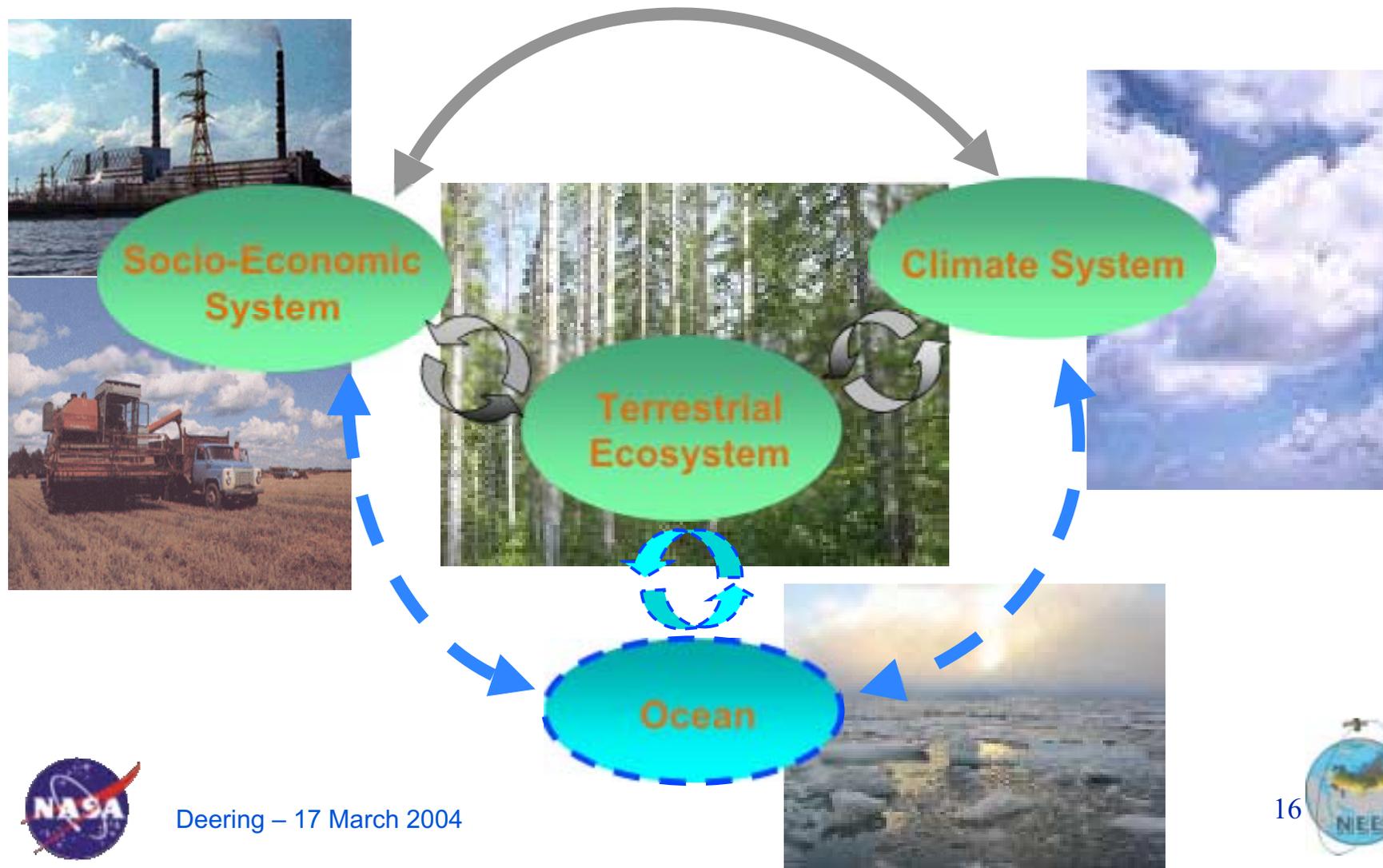
What are (will be) the consequences of the present-day and projected climate and environmental changes in Northern Eurasia for surrounding regions and the Earth's global system?

What are (will be) the consequences of global changes for regional environment, economy, and quality of life in Northern Eurasia?

Feedback: What will be the consequences of socio-economic changes in Northern Eurasia on environment? How will this anthropogenic impact on ecosystems change in Northern Eurasia and over the globe?



Primary Components for study in Northern Eurasia as part of the Global System



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NEESPI Science Plan

Current Organization of Major Science Elements

Terrestrial ecosystem dynamics

Carbon and other biogeochemical cycles

Energy fluxes and water cycle

Land use interactions: societal-ecosystem linkages

Ecosystems and climate change interactions

Cold land processes

Coastal zone processes

Atmospheric aerosol, pollution, dust

Remote Sensing of the Earth System

Terrestrial ecosystems

Coastal zone and inner water bodies

Cryosphere

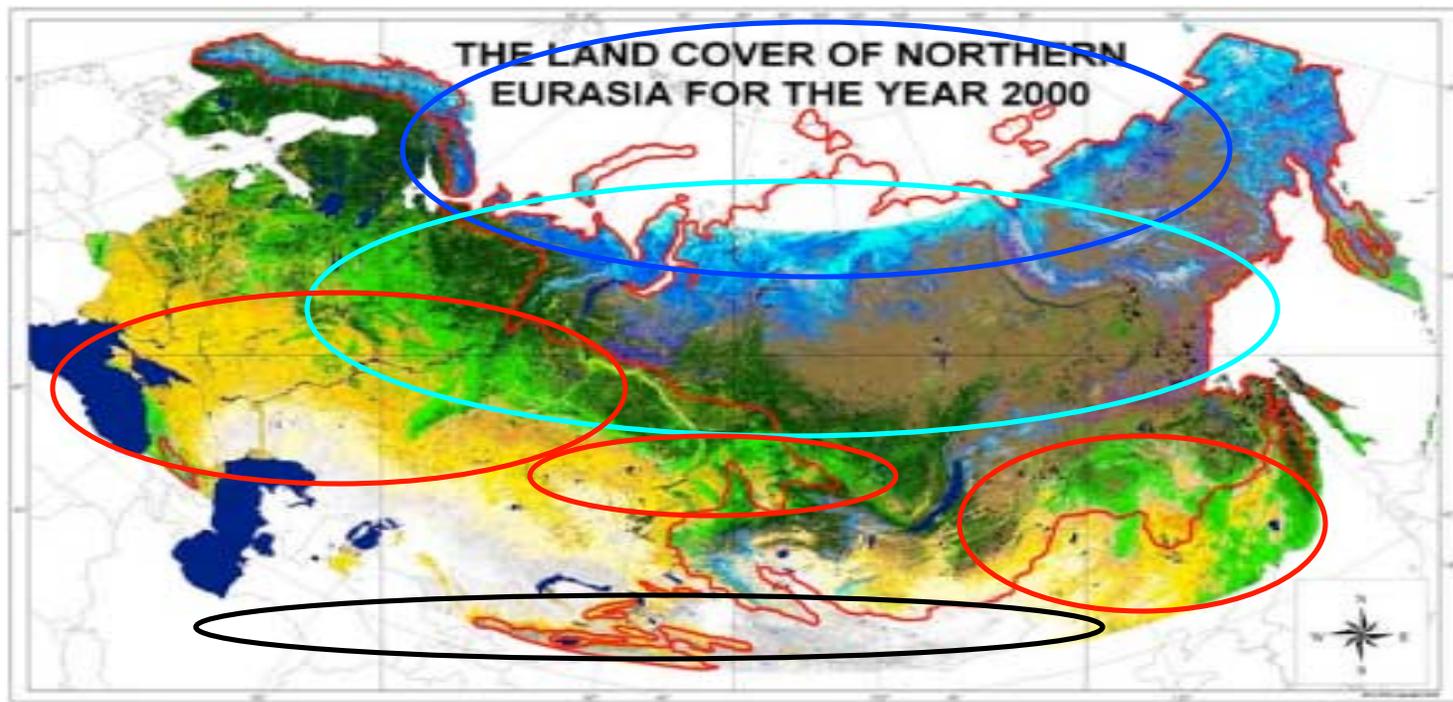
Surface energy and water balance components

Modeling and Integration

Human Interactions



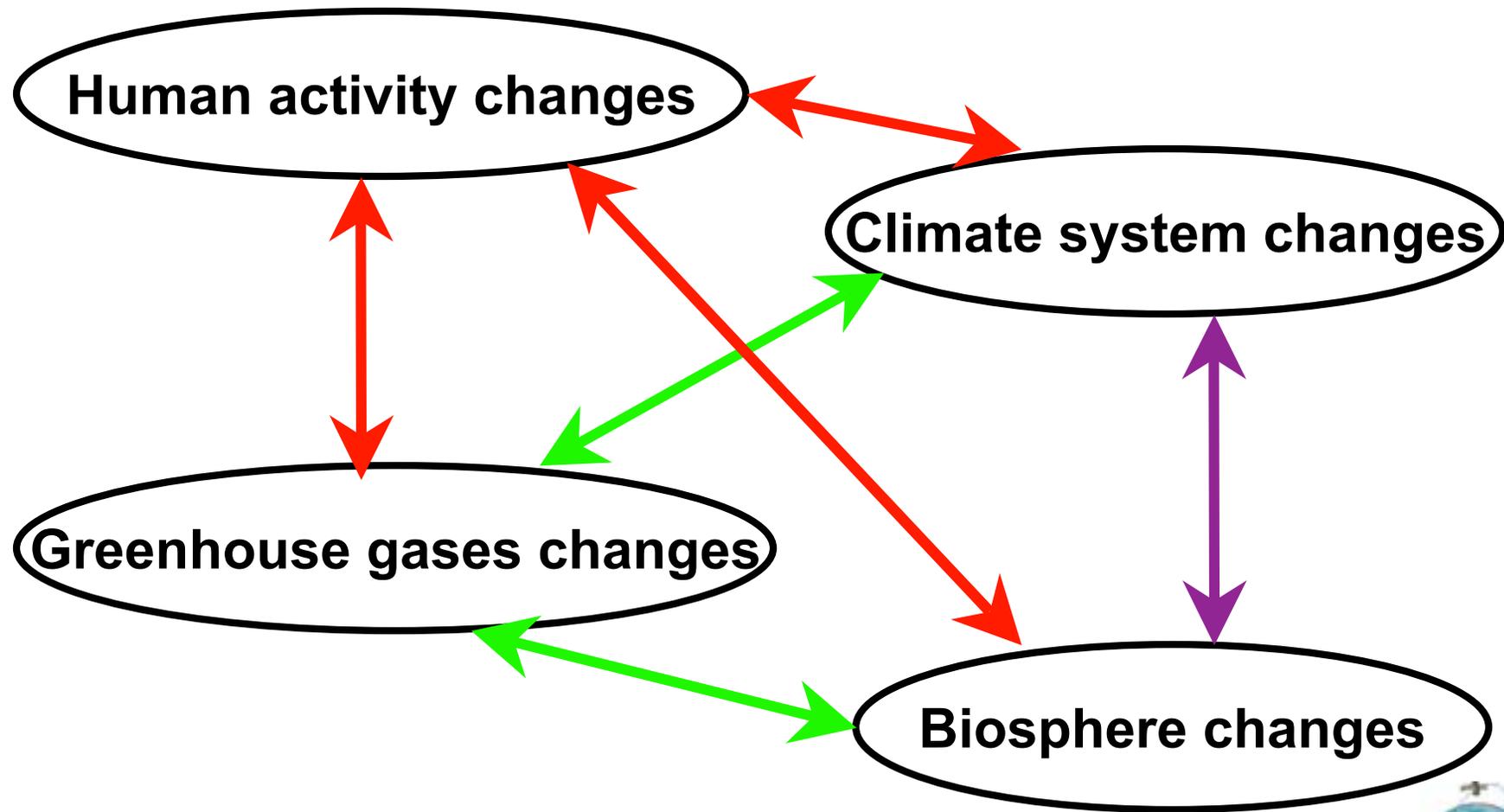
Major geographical foci for Study



- Focus on transient zones that are most vulnerable in the future changes
- Focus on feedbacks that make the projection of the future changes uncertain



A synergetic approach to study and project the future changes



Some Science Questions from Terrestrial Ecology for Biogeochemical Cycles:

**NEESPI BGC Science questions (1):
re., Patterns and Variability**

What are the current geographical and temporal distributions of the major pools and fluxes of carbon and other elements in Northern Eurasia that are important to the functioning of the climate system and human society?



NEESPI BGC Science questions (2): re., Processes and Interactions

What are the major drivers and feedback mechanisms – both anthropogenic and non-anthropogenic – that control the dynamics of the carbon and other important biogeochemical cycles at local, regional, and continental scales in Northern Eurasia?



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NEESPI BGC Science Questions (3): re., Responses of Biogeochemical Cycles

What are the likely future dynamics of biogeochemical cycles in Northern Eurasia that are important to the functioning of the climate system and human societies?



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NEESPI BGC Science Questions (4): re., Management of the Biogeochemical Cycles

What points of intervention and windows of opportunity exist for human societies to manage biogeochemical cycles in Northern Eurasia in a way that mitigates the effects of global change on the climate system and human societies?



NEESPI ~10 year goals

- An integrated observational knowledge data base for environmental studies in Northern Eurasia
- A suite of process –oriented models for each major terrestrial process in all its interactions (including those with the society)
- A suite of global and regional models that seamlessly incorporate all regionally specific feedbacks associated with terrestrial processes in Northern Eurasia and serve as a major tool for both future environmental change projections and for informed decisions on land use and environmental protection policies.
- A system in place that can serve the emergency needs of the society (early warning / management / mitigation of floods, fire, droughts, and other natural disasters)



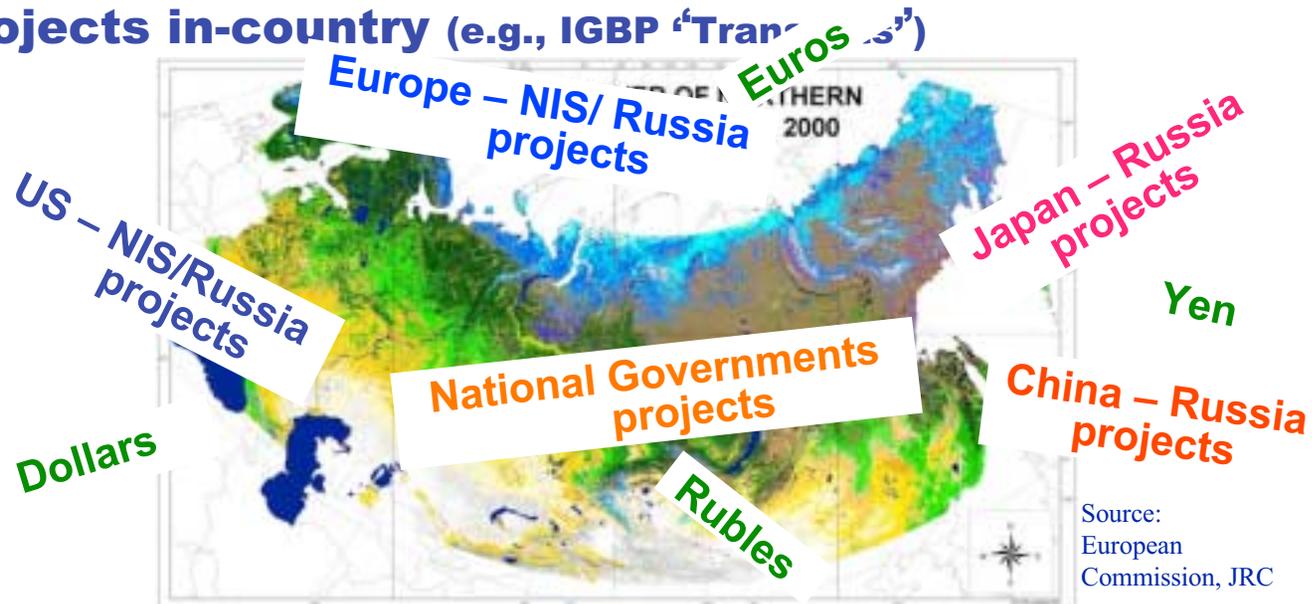
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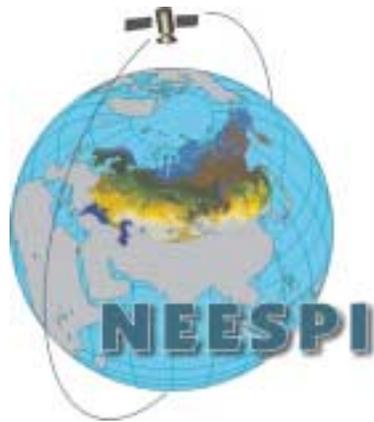
Current, in Northern Eurasia the Region is Studied:

- **Unilaterally, by national government scientists in-country**
- **Bi-laterally, by national scientists with foreign scientist collaborations on independent studies in-country**
- **Unilaterally, by foreign scientists using remote sensing technologies**
- **Internationally, through specific-focus coordinated projects in-country (e.g., IGBP “Trans-Euro-Siberia”)**



So What Is The Problem?

Lack of sufficient data and adequate understanding of the functioning of the biophysical system *for the entire region* through adequately funded projects with international participation to allow for sustainable development and accurate prediction for a variety of national and international goals.



Source:
European
Commission,
JRC

**Russia – US – European – Japanese – Chinese – NIS Projects for
Integration and Predictive Modeling Meeting Needs of All Participants**

International -- Science Plan, Coordination and Implementation



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NEESPI Planning Vision

and

What Is the Meaning of

‘*Strategic Evolution?*’

When NEESPI reaches its developmental maturation for full implementation, NEESPI should –

- Involve many, if not most, countries within the boundaries of Northern Eurasia
- Be **multi-national**
 - in scientific **participation**
 - in project funding **sponsorship**
 - in project organizational **leadership**

Including,

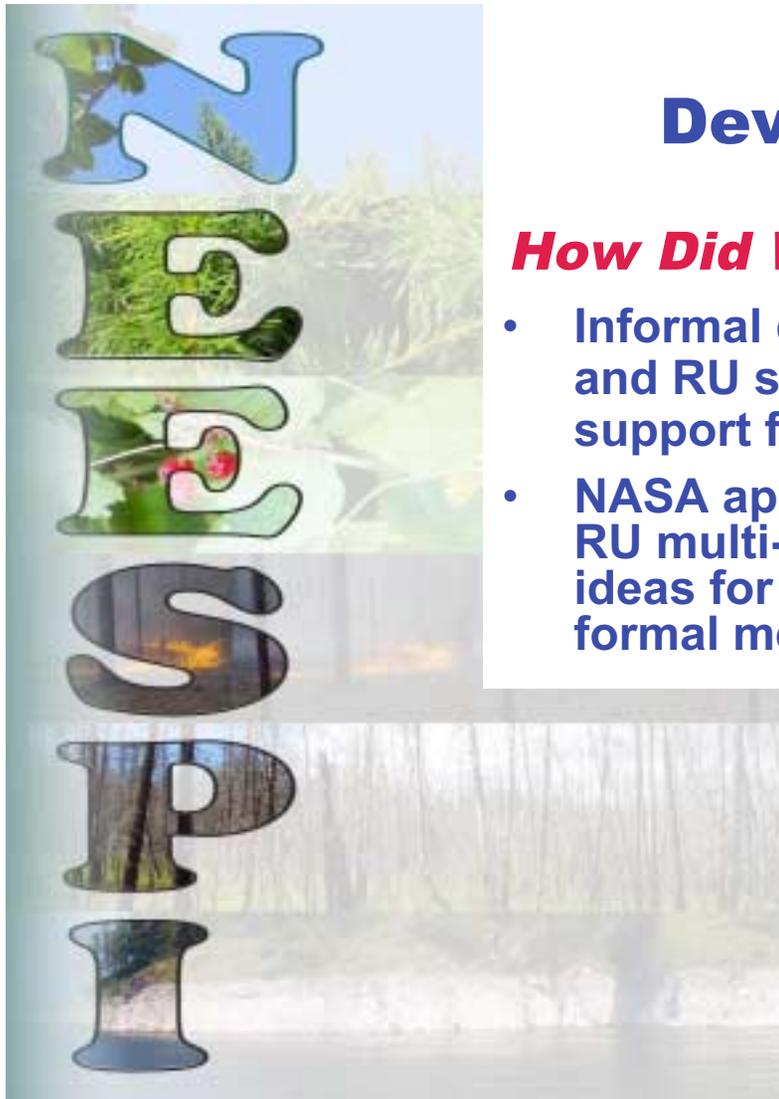
- multiple US government agencies
- multiple Russian government agencies
- multiple European government agencies
- etc.



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The NEESPI

Developmental Evolution:

How Did We Get to Where We are Today?

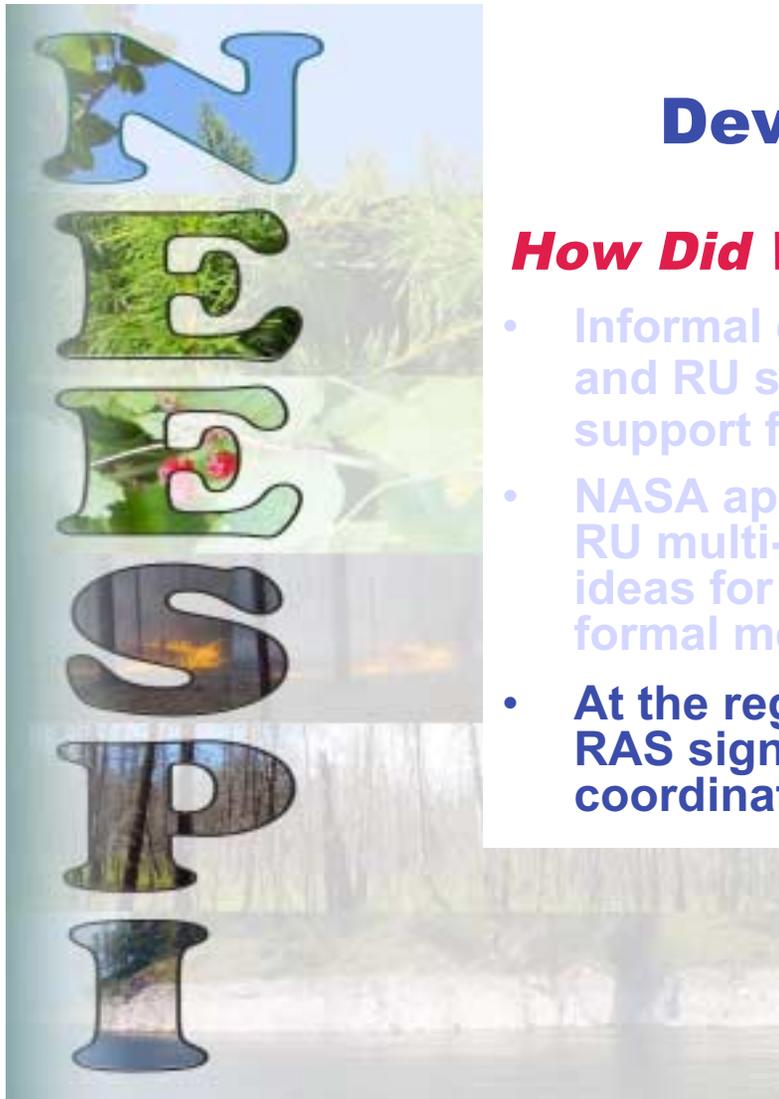
- Informal discussions among collaborating US and RU scientists – better coordination and support for implementation issues – **2001**
- NASA approaches RAS colleagues; organize RU multi-agency planning meeting – share ideas for a major Northern Eurasia project; 1st formal meeting at RAS Presidium - **Feb. 2002**



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- At the regular meeting of ESJWG; NASA and RAS signed agreement to develop a program of coordinated research or NEESPI – **Oct. 2002**



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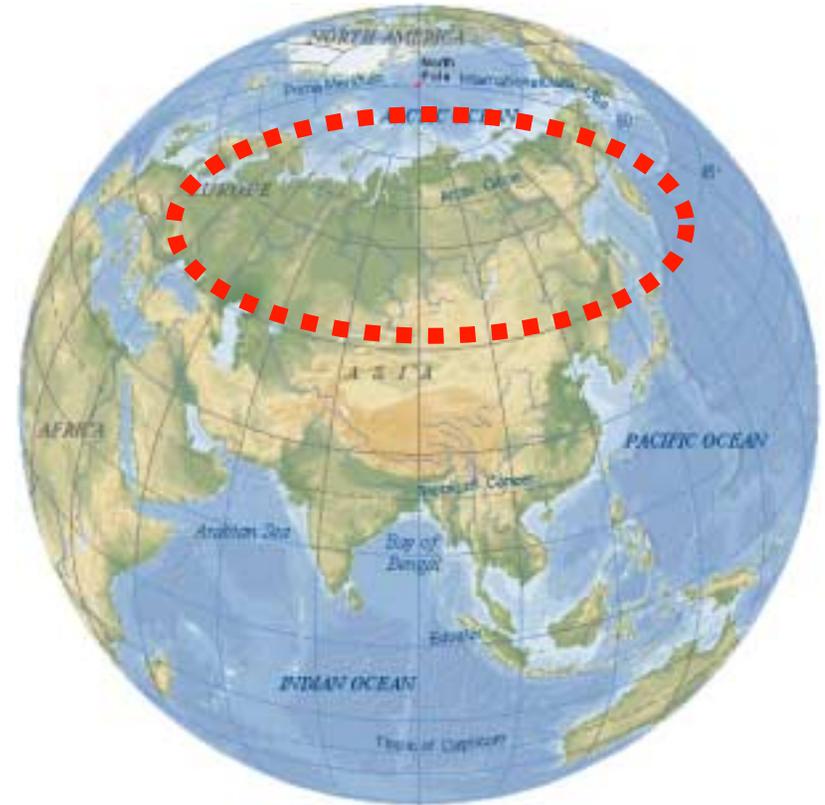


NEESPI Mission Statement

from Formal NASA-RAS Agreement to Develop NEESPI

” . . . the **Northern Eurasia Earth Science Partnership Initiative (NEESPI)** . . . will identify the critical science questions *and establish an [international] program of coordinated research on the state and dynamics of terrestrial ecosystems in northern Eurasia and their interactions with the Earth,s climate system to enhance scientific knowledge and develop predictive capabilities to support informed decision-making and practical applications*”

-- adapted from 12th ESJWG Summary of Discussion, 30 October 2002, Moscow



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The NEESPI

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- At the regular meeting of ESJWG; NASA and RAS signed agreement to develop a program of coordinated research or NEESPI – **Oct. 2002**
- **First NEESPI Science Plan development workshop in Suzdal, Russia – Apr. 2003**
- **Formal evaluation of first draft of Science Plan by independent scientific committee in Yalta, Crimea – Sep. 2003**

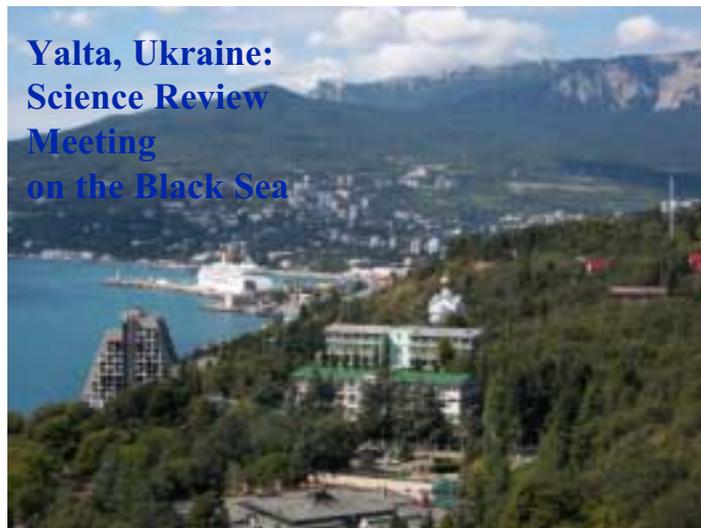


Science Plan Development Workshops in 2003

- April 21 - 25 2003:
1st NEESPI Science Plan Workshop
Suzdal, Russia.



Suzdal, Russia:
NEESPI Science
Plan Workshop
Participants



Yalta, Ukraine:
Science Review
Meeting
on the Black Sea

- September 7-9, 2003:
NEESPI Science Review Meeting



Yalta, Crimea - Ukraine





The NEESPI

Developmental Evolution:

Science Plan Status:

The Revised NEESPI Science Plan is nearing completion of the writing phase with more than 30 primary authors and approximately 100 contributors.

The Yalta Science Review Committee and the NEESPI Science Steering will begin a final review and edit of the Science Plan beginning early April 2004

US and Int'l Agency Program Managers
NEESPI Science Review Meeting

Then What?



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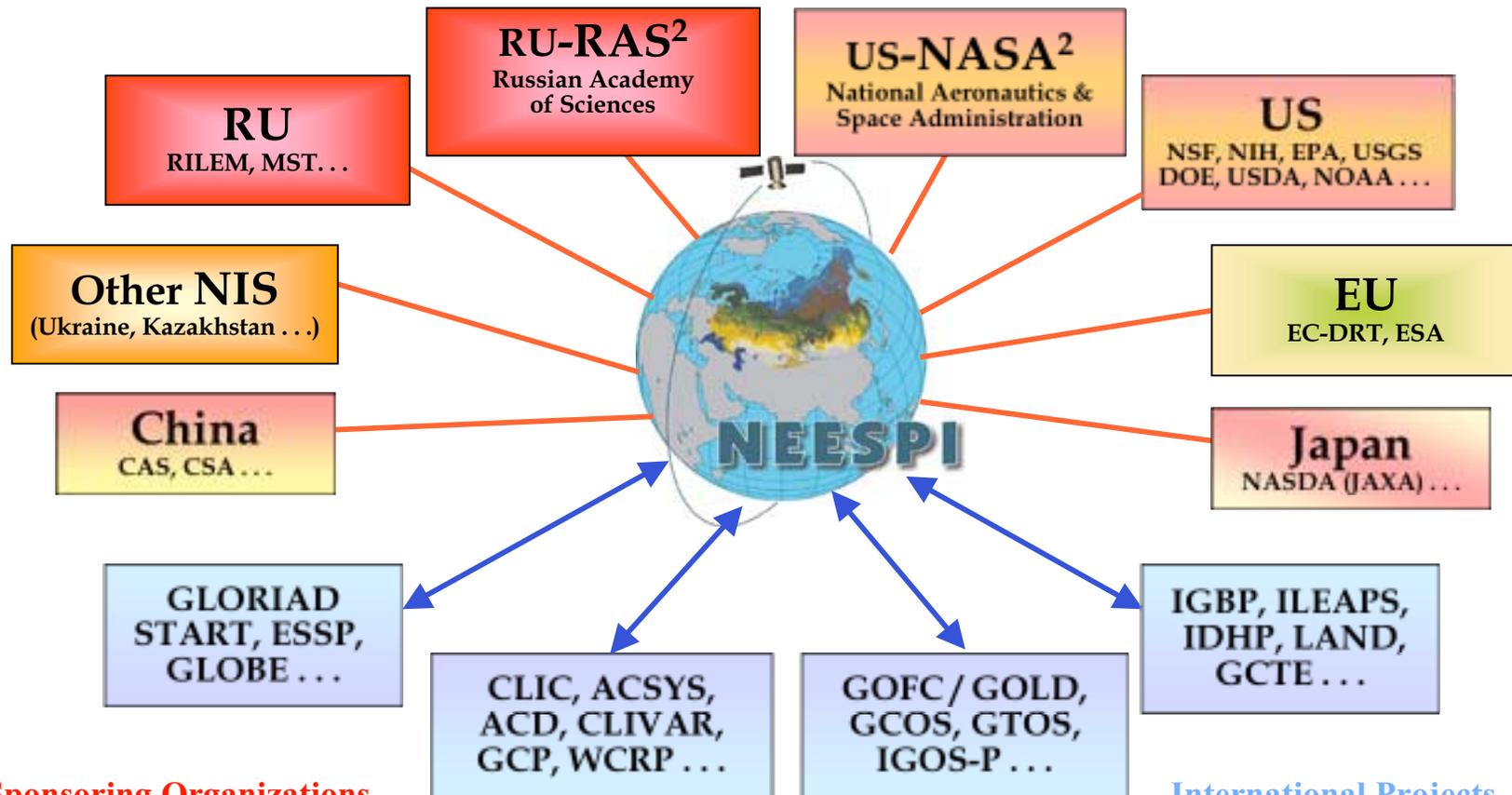
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Phases of the NEESPI Development & Implementation Strategic Evolution

- NAS-RAS are in the primary developmental roles now, but NEESPI is intended to be a **broad-based international program of supported (funded) research**, and it is currently on a developmental path to realize this goal.
- Bringing all **potential stakeholders** into the process as *equal partners* **requires time and advocates** to both develop the strategy, inform the potential partners and follow through in organizing their involvement into the program.
- NEESPI seeks connections and will **operate synergistically** with a variety of national and **international science** (e.g., IGBP) **and other programs and projects** (e.g., GOFIC/GOLD; GLORIAD) – particularly those relevant to Global change research.



NEESPI SPONSORSHIP AND LINKAGES¹



Sponsoring Organizations

- NEESPI Program Development
- Research Funding Support
- Organization & Implementation Committee

International Projects

- Scientist Networks
- Data Sharing
- Data Analysis/ Synthesis

¹ anticipated participation with project maturation

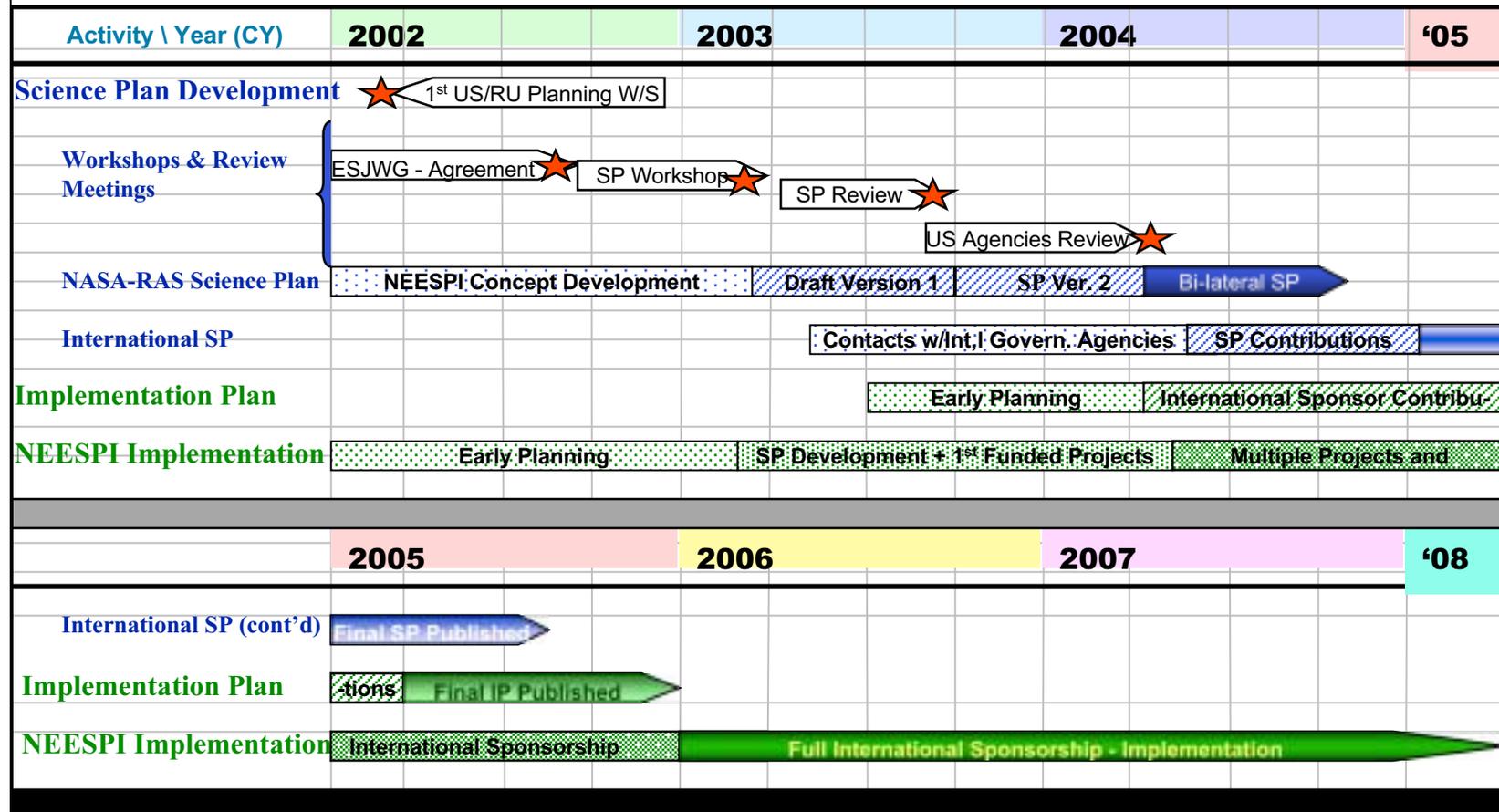
² founding sponsoring organizations

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- A timeline for this strategic evolution reflects the **necessary phased approach**.



NEESPI Development & Implementation Timeline



NEESPI Development & Implementation Timeline

