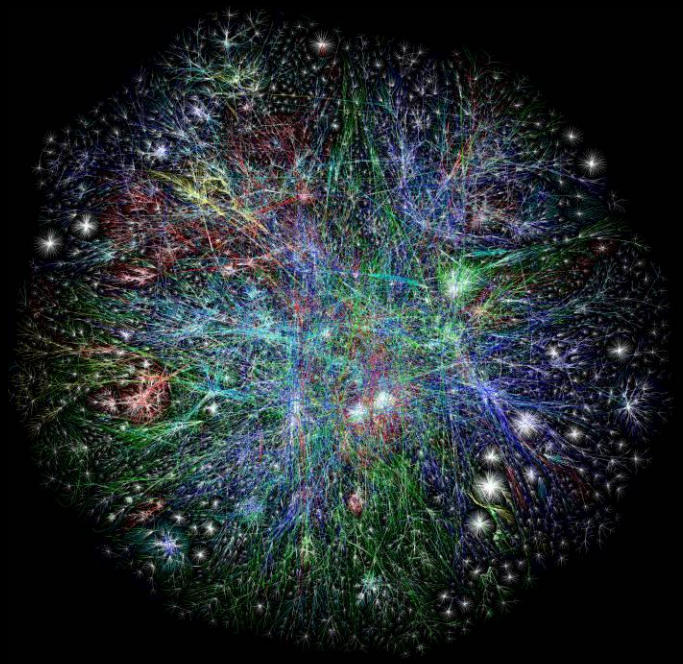
Model collaboration, coordination and… the Model Web for ecological forecasting



From Yesterday

Need to assess impacts of change…

- **"A new generation of integrated modeling is needed" (Tony Janetos)**
- **"Major investment in impact models is needed"**
- **"Need integrated research" (Ex: biofuels/food/crop)**
- **Need "Model comparisons…multi-model analyses…coordinated agenda"**
- **"Need to develop an infrastructure"**
- **"Need to investigate alternative futures"**
- **"Need a new NASA program"**

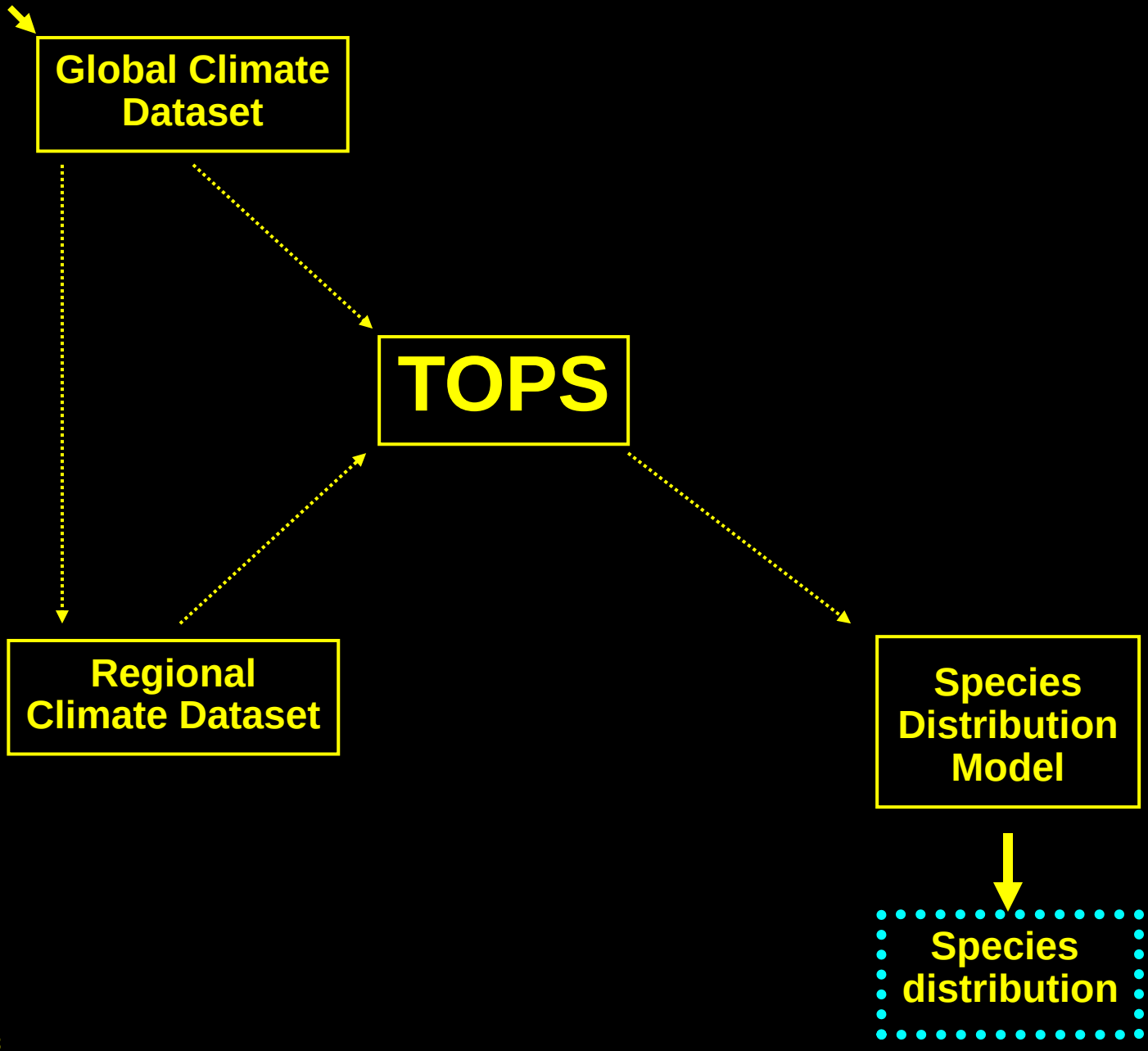
Overview

- Bring people together
- Review Model Web concept
- Discuss strawperson approach to doing it
- Focus on: Initial Framework Infrastructure
  - Right models?
  - Right people?

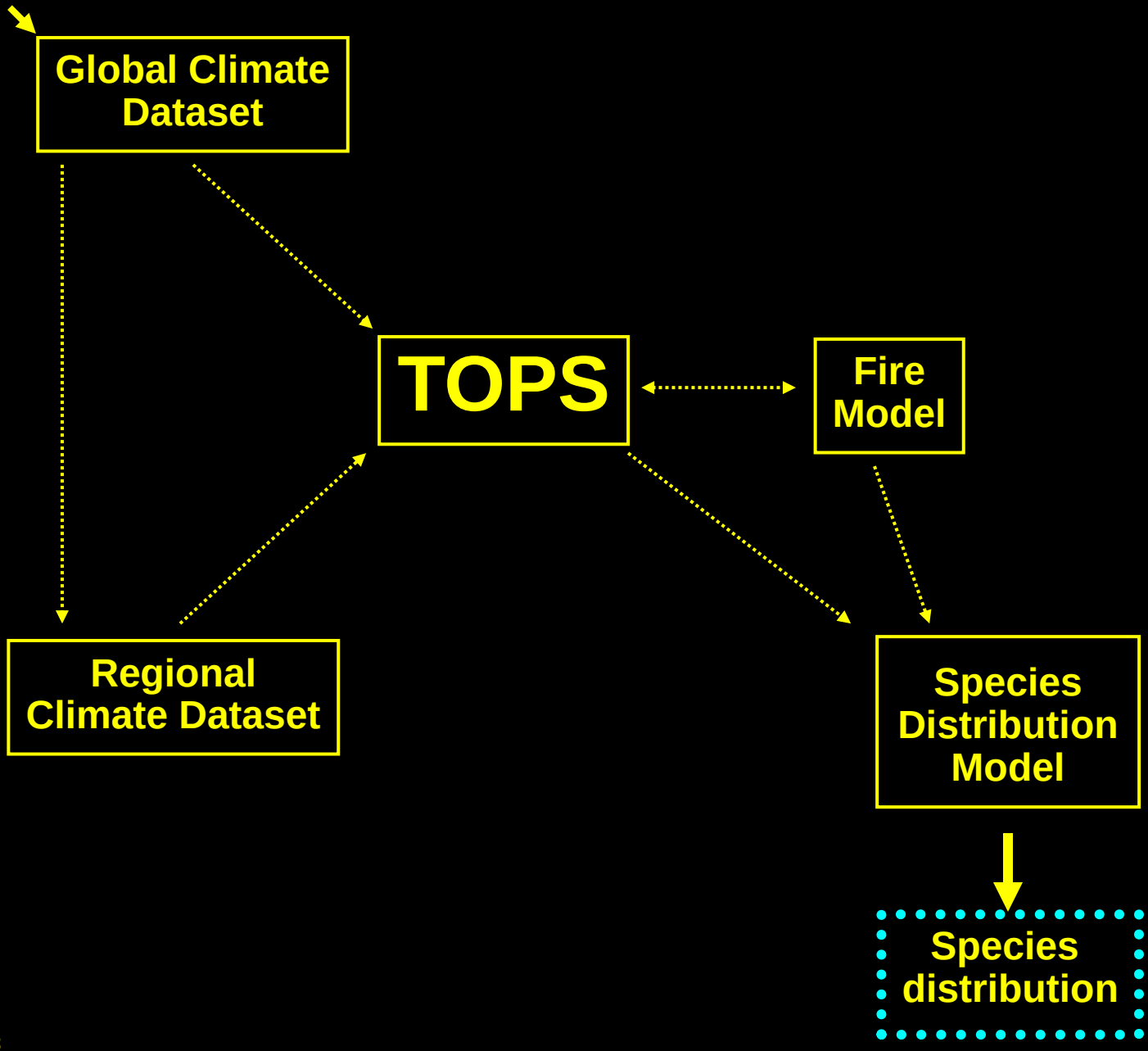
Current Modeling Environment

- Very limited model-model communication
  - Technical and especially non-technical barriers
- Response
  - Try a “web of models” analogous to the WWW
  - Can’t just plan and build it
    - Facilitate and encourage

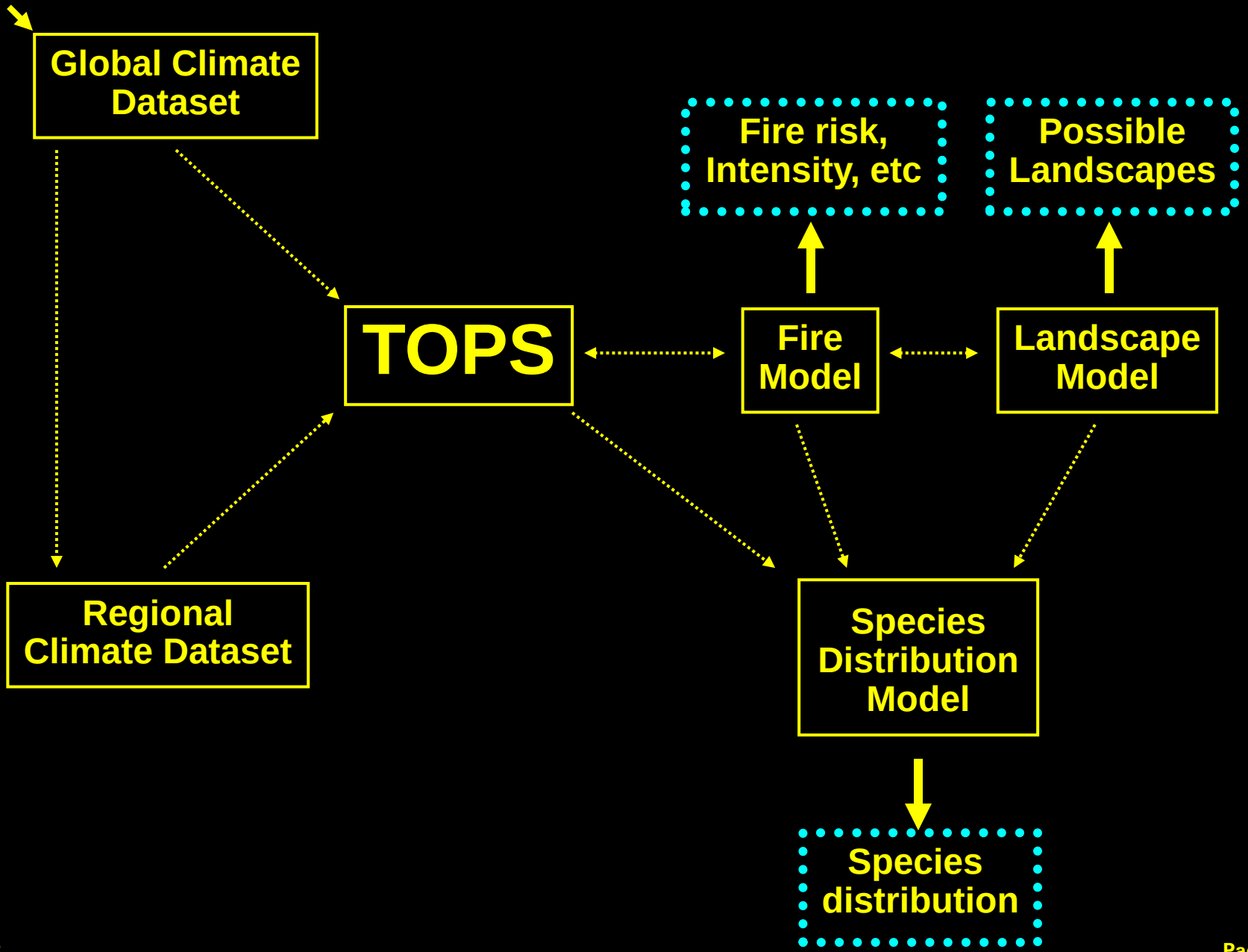
Demonstration System



System Growth



System Growth



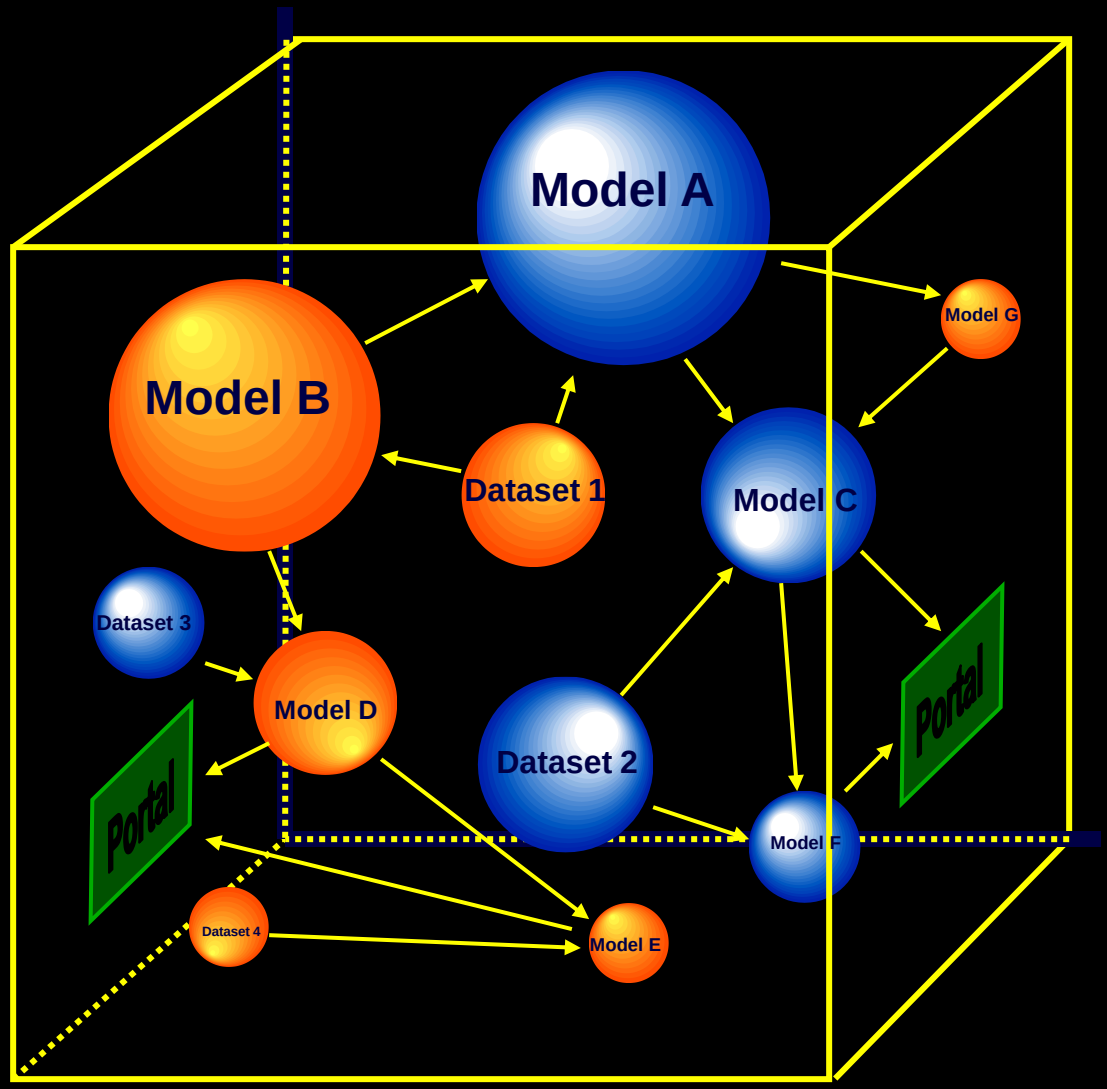
Model Web: 5-10+ Year Vision (1/2)

- Distributed network of interoperating models (and datasets and sensors)
- Using web services
- Models are harmonized
- Multi-disciplinary scope

Model Web: 5-10+ Year Vision (2/2)

- Grows organically within framework of broad goals and data exchange standards
- Models and datasets maintained, operated, and served independently
- Web access provided to researchers, managers, policy makers, public

Model and Data Space

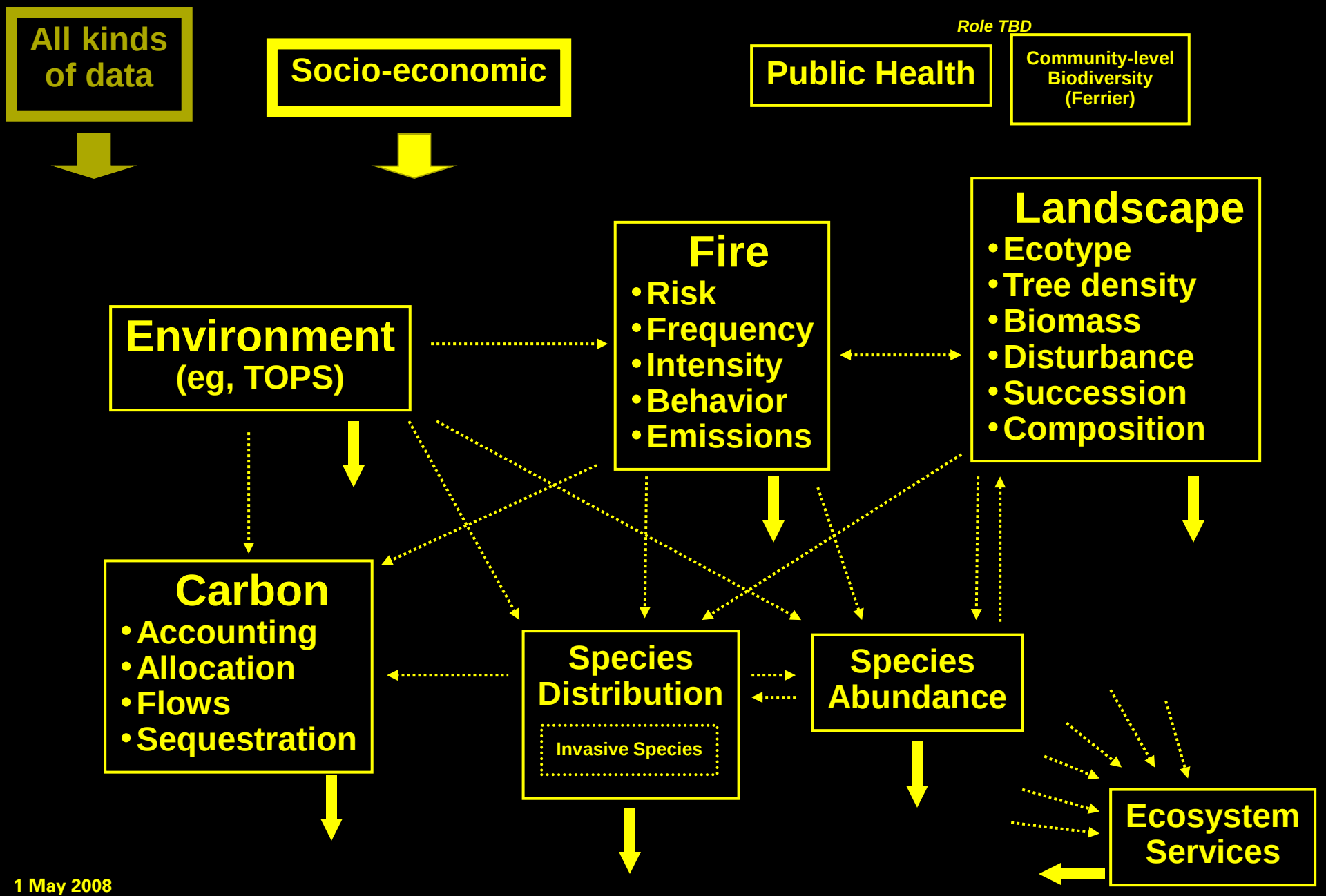


Model Web	"Traditional"
Harmonization of components a lot of work	Harmonization of components a lot of work
Communication by web services	Communication by API/system calls
Dynamic, interoperable system of systems	Static, isolated, integrated systems
Loosely coupled components	Tightly coupled components
Distributed system lacking centralized control	Centralized system controlled by developers
Open system. New components added without permission	Closed system. New components only added by system developers
Organic and opportunistic growth, similar to WWW (but guided)	All growth planned
High level of component reuse—once harmonized with other components a component is available to everyone	Low level of reuse; once harmonized with other components remains within the tightly coupled system
Generally high level of data sharing	Generally lower level of sharing; focus is on specific questions and tightly coupled components so that only final products are shared
Indeterminate growth	Determinate growth as defined by developers
Long term evolutionary process that gradually converges on higher levels of interoperability	Shorter term development process with complete interoperability at delivery
Leads to a shared modeling infrastructure accessible by all	Leads to isolated model systems available to a few
Untrained users may misuse model or outputs	Misuse rarer because users and developers are typically the same
Unsuitable for systems that require high levels of data exchange between components	High levels of data exchange less of a problem due to co-location of components

Next Step

- Think about an initial “framework infrastructure”
- Expand demo system
- Include additional basic components

Strawperson Initial Framework Infrastructure



1 May 2008

Selection Criteria

- Model developer is engaged
- Model developer is broad thinker and shares vision of a model infrastructure
- Models have potential for harmonization

Model or Category	Modeler	Model information
NASA TOPS	Rama Nemani (NASA)	Environmental information past, present, future, including temperature, rainfall, radiation, LAI, soil moisture, stream outflow, ET, vegetation stress, primary productivity
GEOSS GBIF IP3 demo system	Stefano Nativi (Italian National Research Council)	Uses OpenModeler and GBIF to produce range maps based on the provided climate
Community models	Simon Ferrier (CSIRO, Australia)	TBD
Carbon	Yiqi Luo (Univ of Kansas)	TBD
Fire	TBD	Many options; Nativi has a Mediterranean model, TOPS will likely add an emissions model; USFS has many models; risk, intensity, frequency, coverage, emissions are of interest
Landscape	eg, LANDIS--Rob Scheller (Conservation Biology Institute)	LANDIS has a fire module as well as other components that are loosely coupled and available as DLLs. Should also check into the Ecosystem Demography model (Paul Moorcroft, George Hurtt)
Socioeconomic	Robert Costanza's group (Gund Inst for Env Economics)	Ecosystem services, predicted landcover change; roads; etc
Public health	EPA--Gary Foley's group	TBD
Ecosystem services	EPA—Rick Linthurst's group, with John Johnston	TBD
Invasive species	Jeff Morisette and John Schnase (NASA)	NASA Invasive Species Forecasting System; predicts likely spread of invasives

Related Topic

- Chris Field and Modeling Breakout group
  - Coordination in assessing impact of change
  - Would enhance application of model results
  - Form a working group?

Next Steps

- Expand demo system to Initial framework system
- Finalize models and participants
- Submit proposals?
- Plan Model Web Workshop
- Impact modeling WG for coordination?

Principle of Gradual Convergence

- Vision cannot be achieved quickly
  - Gradually converged upon
- Cannot be achieved completely
  - Not necessary
- Follow path of organic growth
  - Organized around general framework
  - Facilitated by tools and technologies
  - Lubricated by interested sponsors

Barriers to Interoperability

- Data format
- Data terminology
- Missing data
- Temporal/spatial gridding
- Standards
- Sponsor goals
- Model purpose
- Effort required
- Proprietariness
- Acceptance
- Cultural differences

Technical

Non-technical

Larger infrastructure