

Global trends in tree mortality as indicator of forest health

September 2017
Beijing, China

Henrik Hartmann

Max Planck Institute
for Biogeochemistry



Bill Anderegg



Bernhard Schuldt



GEORG-AUGUST-UNIVERSITÄT
GÖTTINGEN

Tanja Sanders



Jürgen Boehmer



Cate Macinnis-Ng



Most of you likely don't know me...

A multi-species synthesis of physiological mechanisms in drought-induced tree mortality

Henry D. Adams^{1*}, Melanie J. B. Zeppel^{2,3}, William R. L. Anderegg⁴, Henrik Hartmann⁵, Simon M. Landhäusser⁶, David T. Tissue⁷, Travis E. Huxman⁸, Patrick J. Hudson⁹, Trenton E. Franz¹⁰, Craig D. Allen¹¹, Leander D. L. Anderegg¹², Greg A. Barron-Gafford^{13,14}, David J. Beerling¹⁵, David D. Breshears^{16,17}, Timothy J. Brodribb¹⁸, Harald Bugmann¹⁹, Richard C. Cobb²⁰, Adam D. Collins²¹, L. Turin Dickman²¹, Honglang Duan²², Brent E. Ewers²³, Lucia Galiano²⁴, David A. Galvez⁶, Núria García-Forner²⁵, Monica L. Gaylord^{26,27}, Matthew J. Germino²⁸, Arthur Gessler²⁹, Uwe G. Hacke⁶, Rodrigo Hakamada³⁰, Andy Hector³¹, Michael W. Jenkins³², Jeffrey M. Kane³³, Thomas E. Kolb²⁶, Darin J. Law¹⁶, James D. Lewis³⁴, Jean-Marc Limousin³⁵, David M. Love⁶, Alison K. Macalady³⁶, Jordi Martínez-Vilalta^{37,38}, Maurizio Mencuccini^{37,39,40}, Patrick J. Mitchell⁴¹, Jordan D. Muss²¹, Michael J. O'Brien⁴², Anthony P. O'Grady⁴³, Robert E. Pangle⁹, Elizabeth A. Pinkard⁴¹, Frida I. Piper^{43,44}, Jennifer A. Plaut⁹, William T. Pockman⁹, Joe Quirk⁴⁵, Keith Reinhardt⁴⁶, Francesco Ripullone⁴⁶, Michael G. Ryan^{47,48,49}, Anna Sala⁵⁰, Sanna Sevanto²¹, John S. Sperry⁴, Rodrigo Vargas⁵¹, Michel Vennetier⁵², Danielle A. Way^{53,54}, Chonggang Xu²¹, Enrico A. Ypez⁵⁵ and Nate G. McDowell⁵⁶

SPECIAL SECTION

FOREST HEALTH

REVIEW

Forest health and global change

S. Trumbore,^{1,2*} P. Brando,^{3,4} H. Hartmann¹



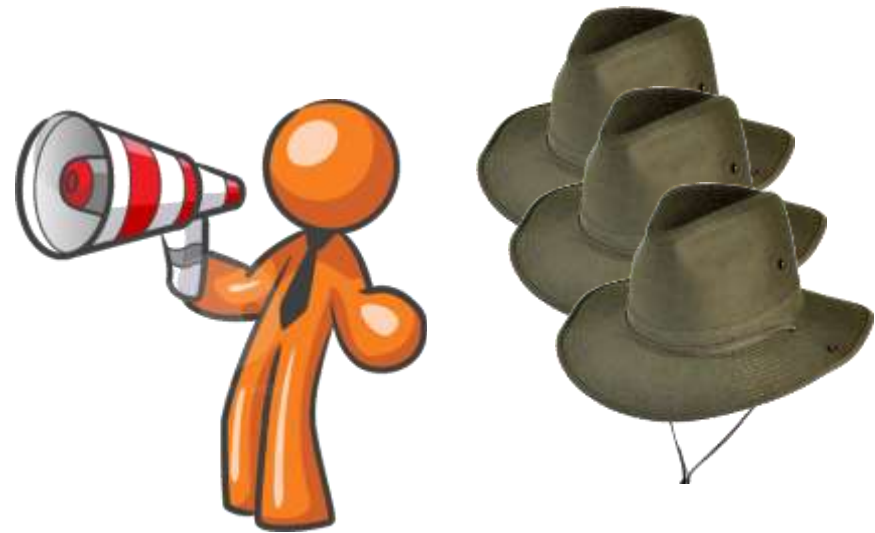
Outline

- What I will not show in this talk:

- Big data
- Nor small data...
- Not even biodiversity

- But I will talk about:

- Forests
- Interdisciplinarity
- Call for DATA SHARING



Data sharing is a key to success in science

Klaus von Gadow

GFBI data base – biodiversity, carbon balance, resource assessment...



...timber production, REDD+, cloud formation...



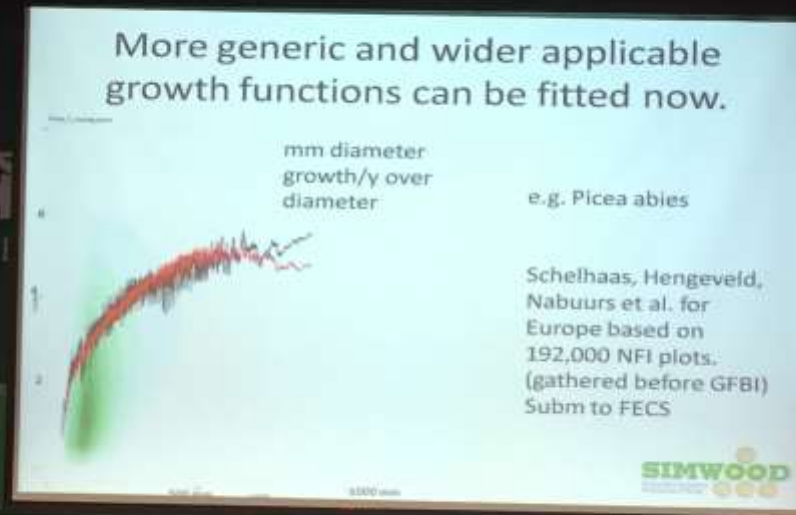
More generic and wider applicable growth functions can be fitted now.

mm diameter growth/y over diameter

e.g. *Picea abies*

Schelhaas, Hengeveld, Nabuurs et al. for Europe based on 192,000 NFI plots. (gathered before GFBI) Subm to FECS

SIMWOOD



Tree mortality as indicator of forest health

- What exactly is forest health?

A healthy tree



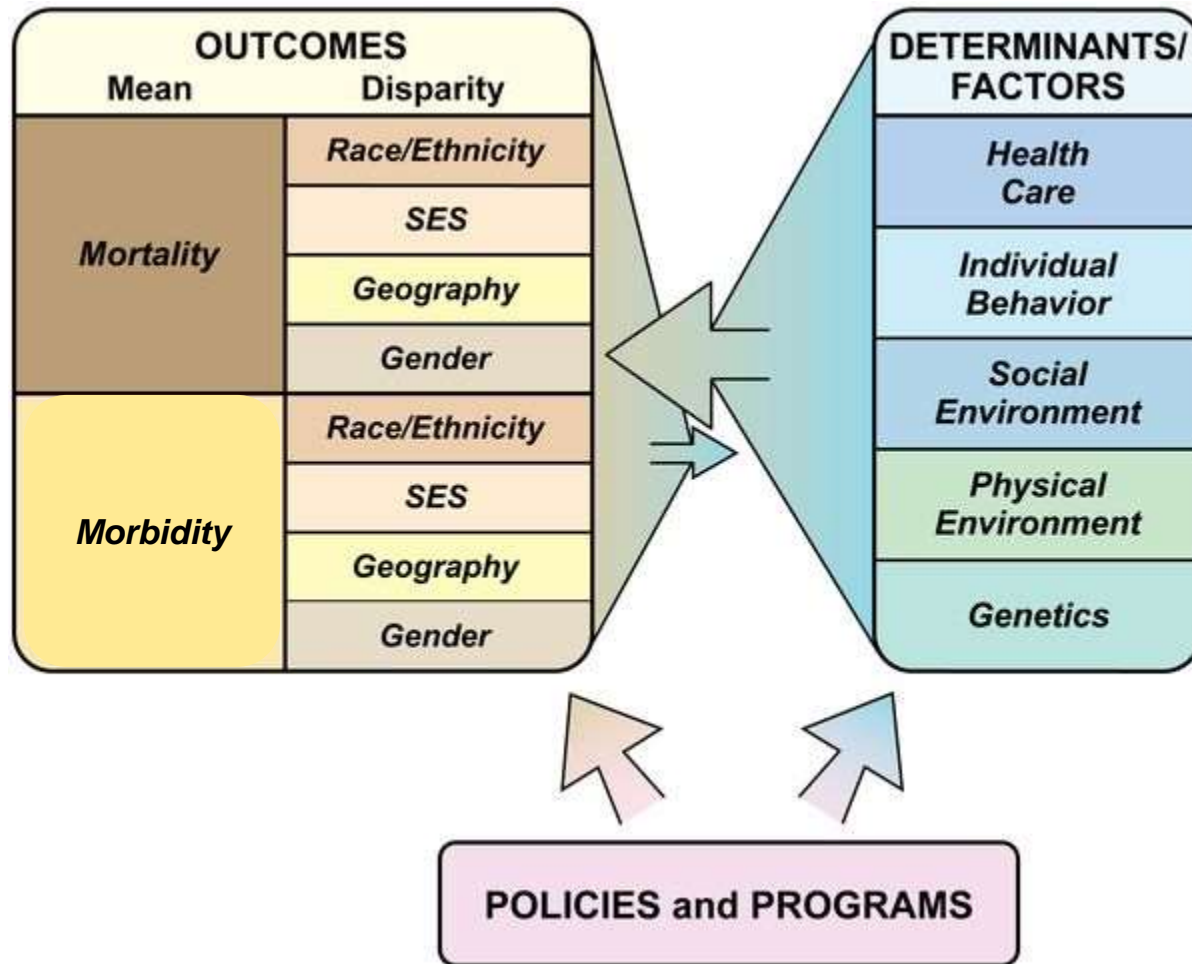
An unhealthy forest?



Human population health

SES = socioeconomic status

Health related
quality of life

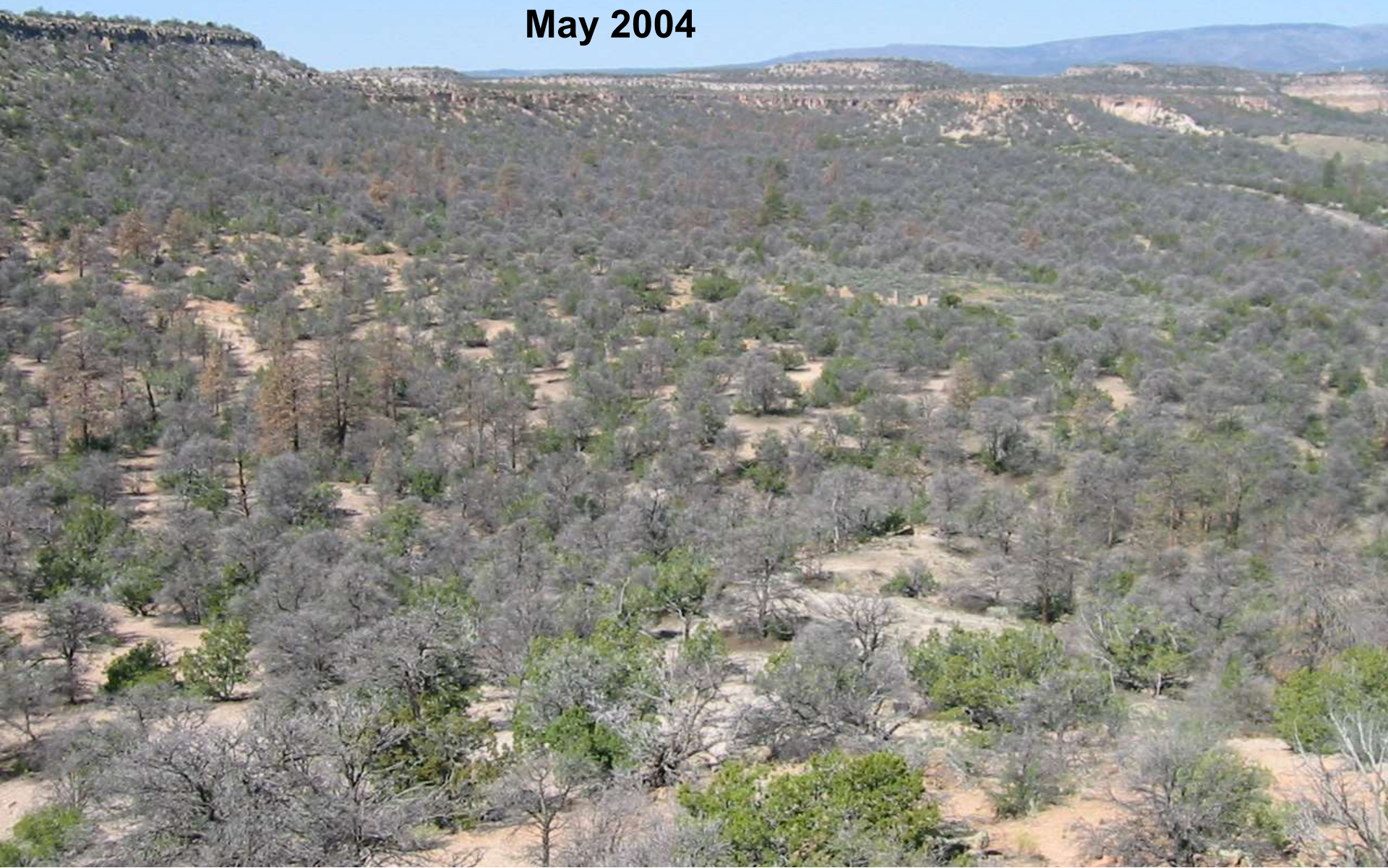


What is forest health?

- Morbidity hard to quantify in non-human populations
 - trees don't go to the doctor
- Indicator of forest health ~ non-normal mortality rates
- Problem: What's non-normal mortality? At what scale?

***Pinus* skeletons, conversion to juniper woodlands, New Mexico**

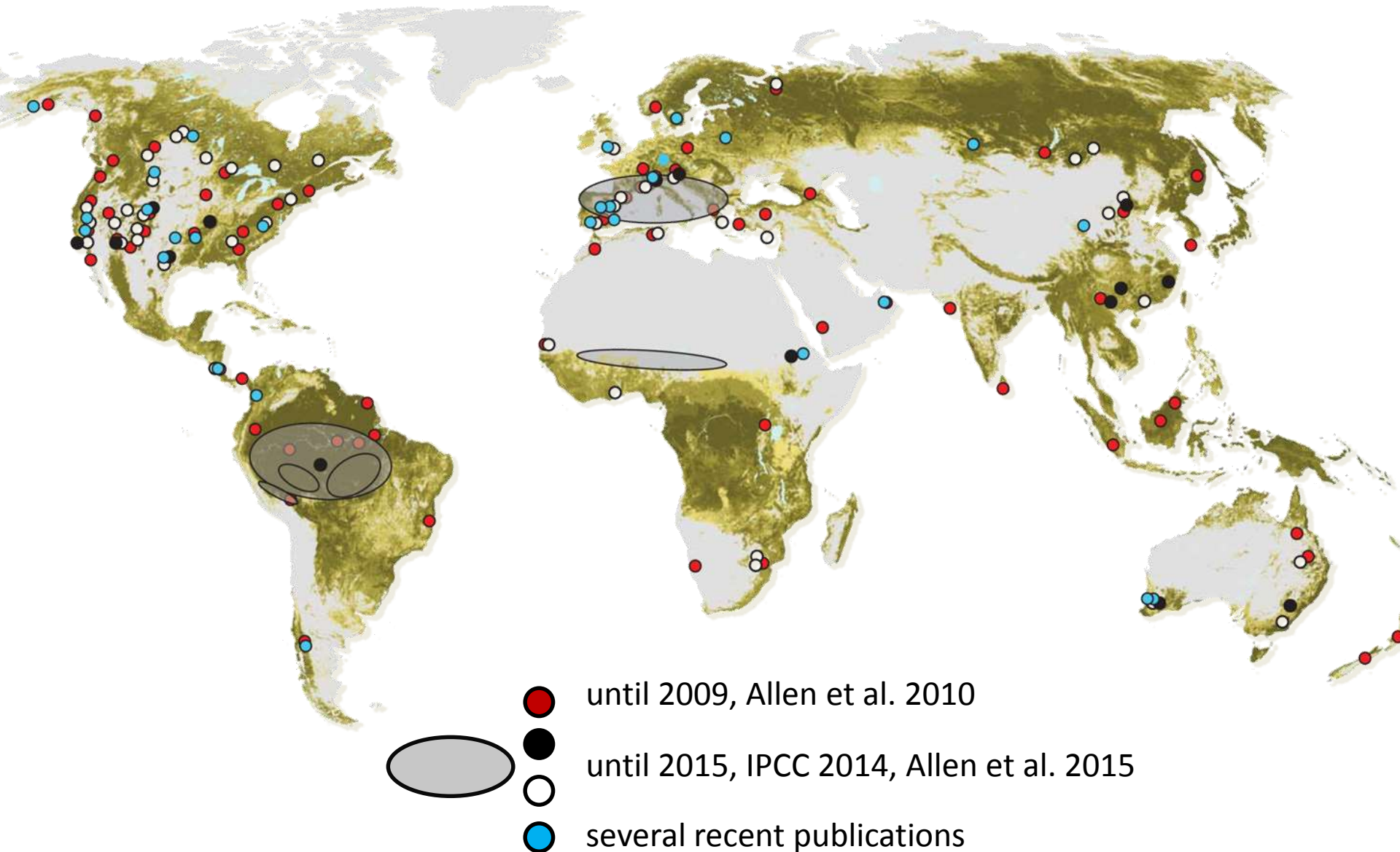
May 2004



> 2 million ha. of tree mortality in the Southwest US alone from 2002 – 2004.

Photo: CD Allen

Non-normal mortality globally from heat and drought



Workshop on tree mortality

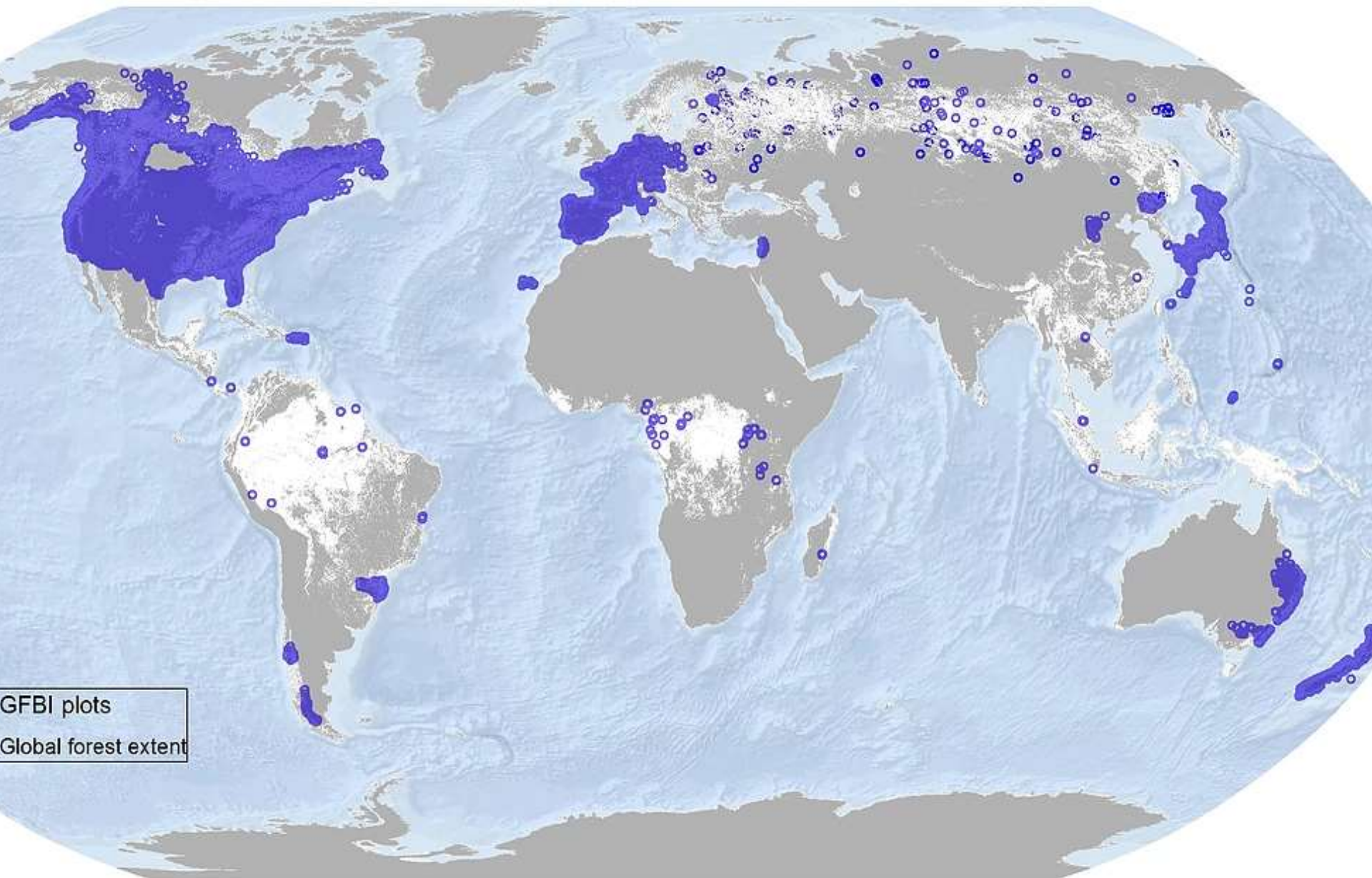
- IIWTM 2014
- Max-Planck Institute for Biogeochemistry, Jena, Germany
- 60+ participants from 18 different countries



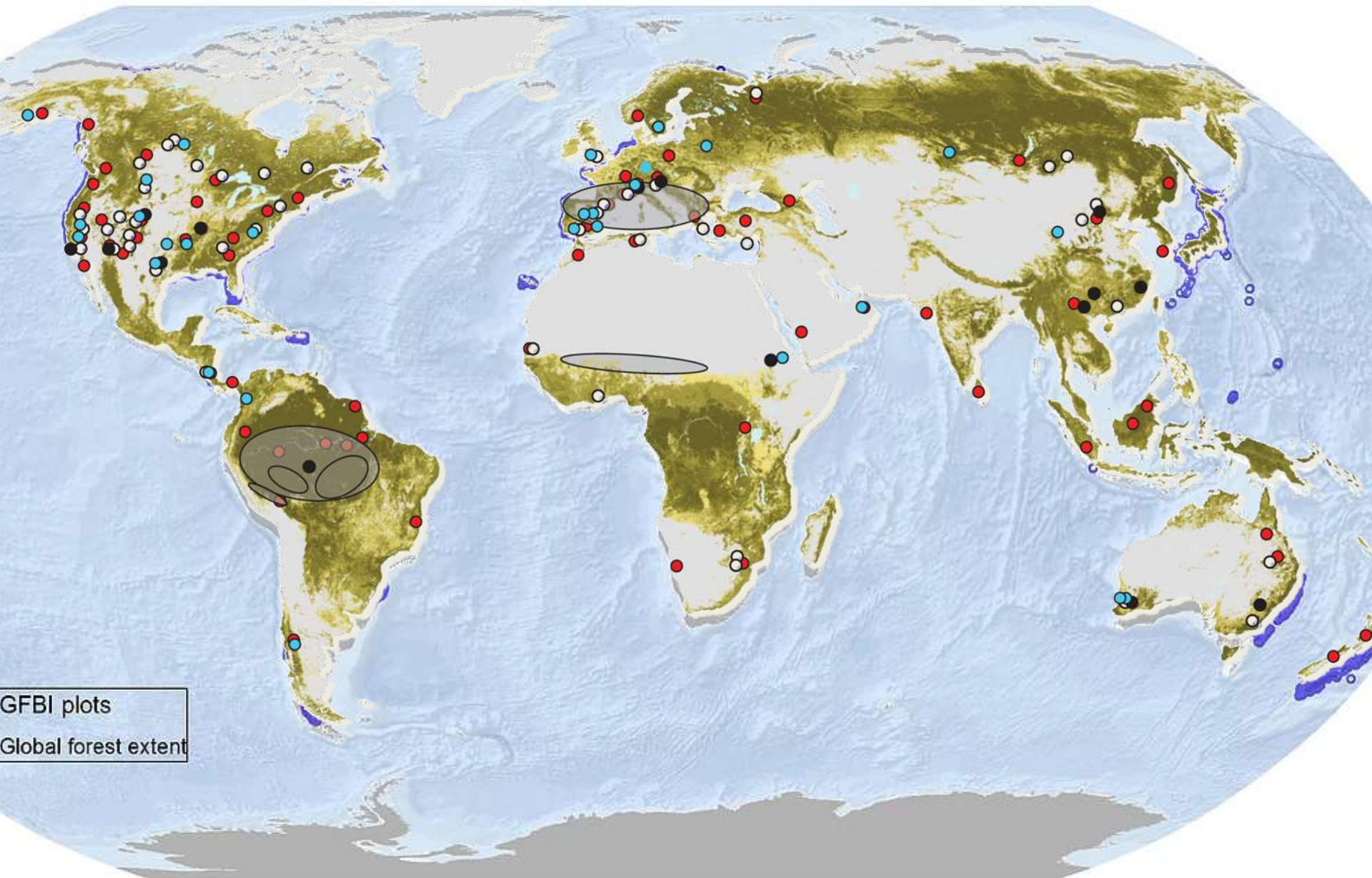
International Interdisciplinary
Workshop on Tree Mortality

Global trends and causes of tree mortality remain highly uncertain!

GFBI plot coverage



How representative are these observations globally?



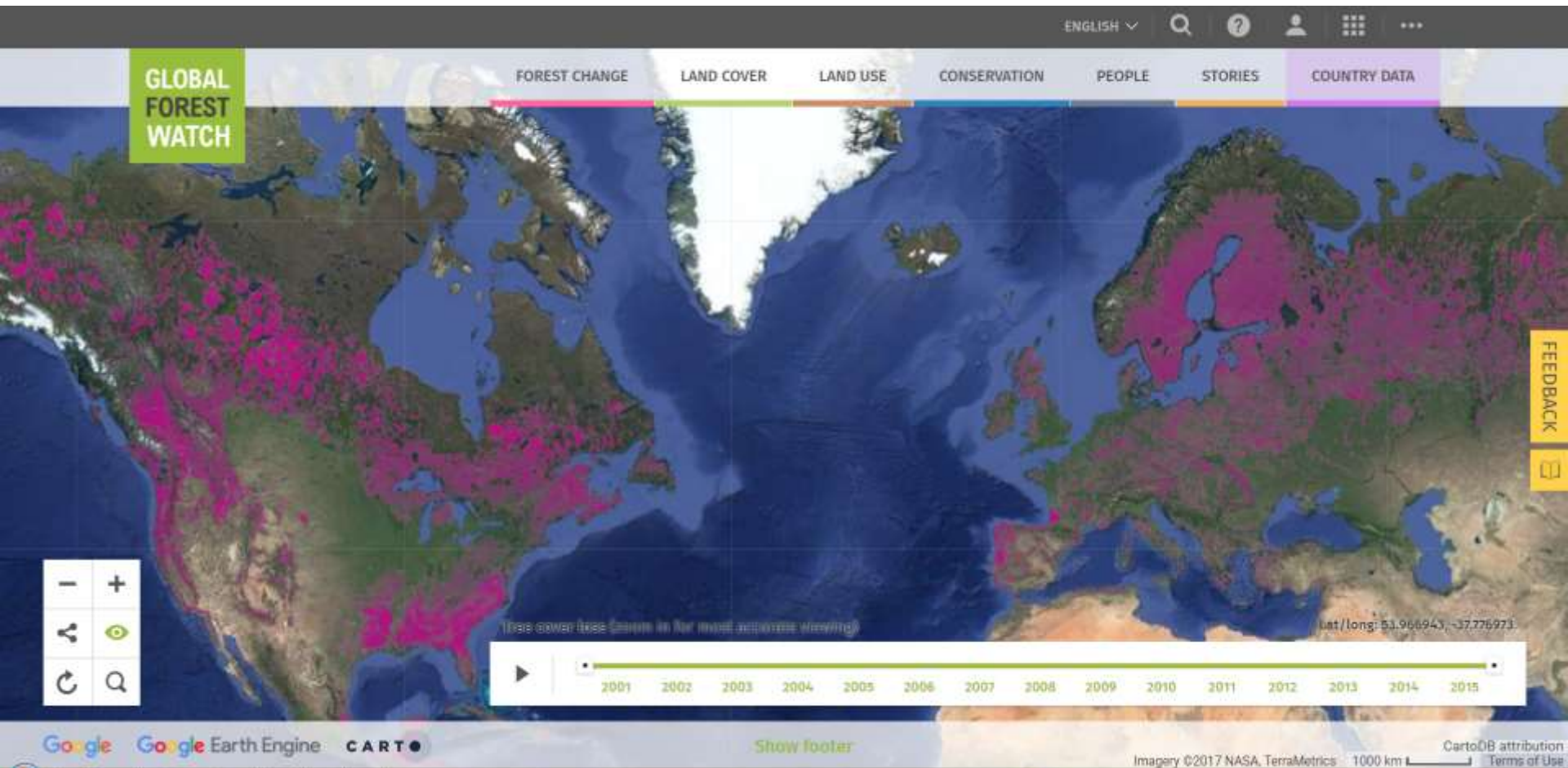
Issues in detecting global mortality and attributing causes

- Global forests cover large areas making detection and attribution of causality a **broad-scale problem**
- Remote sensing allows D&A of forest loss from land-use change, forest management and major disturbances

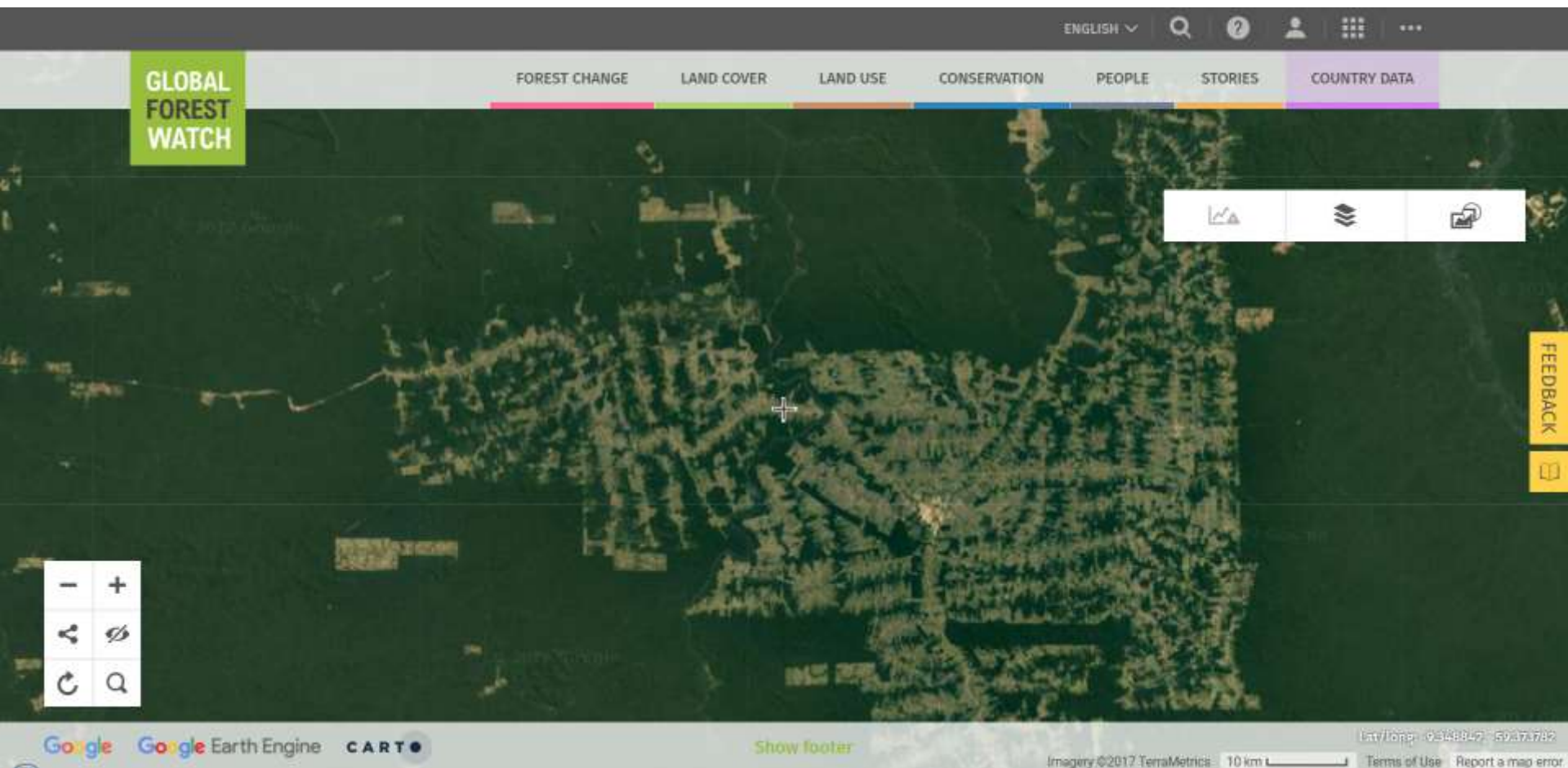
Global Forest Watch is doing just that!!

But...

The Global Forest Watch



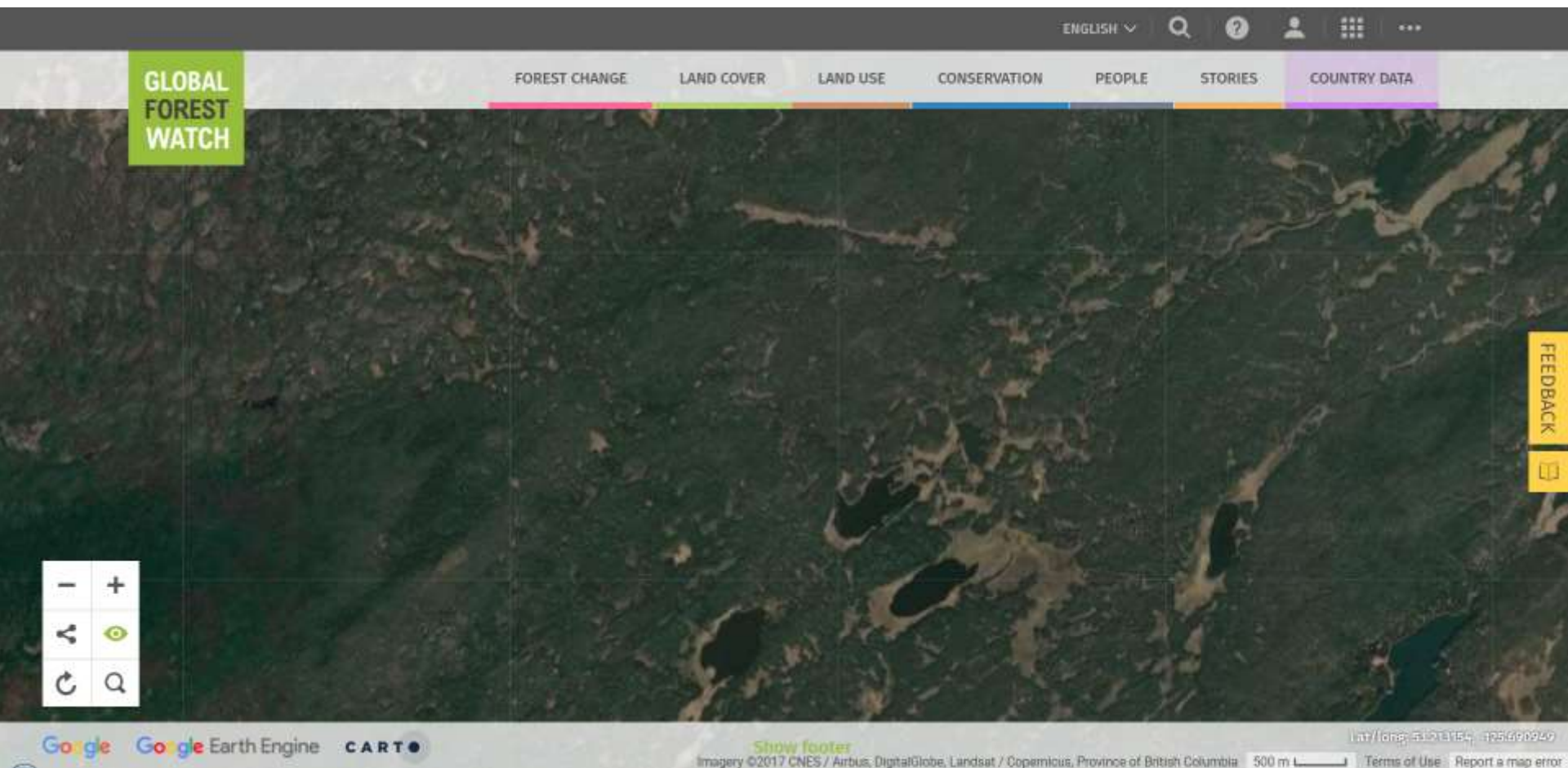
Forest loss from land-use change (Brazil)



Easily detectable



Fuzzy mortality from bark beetles (Canada)



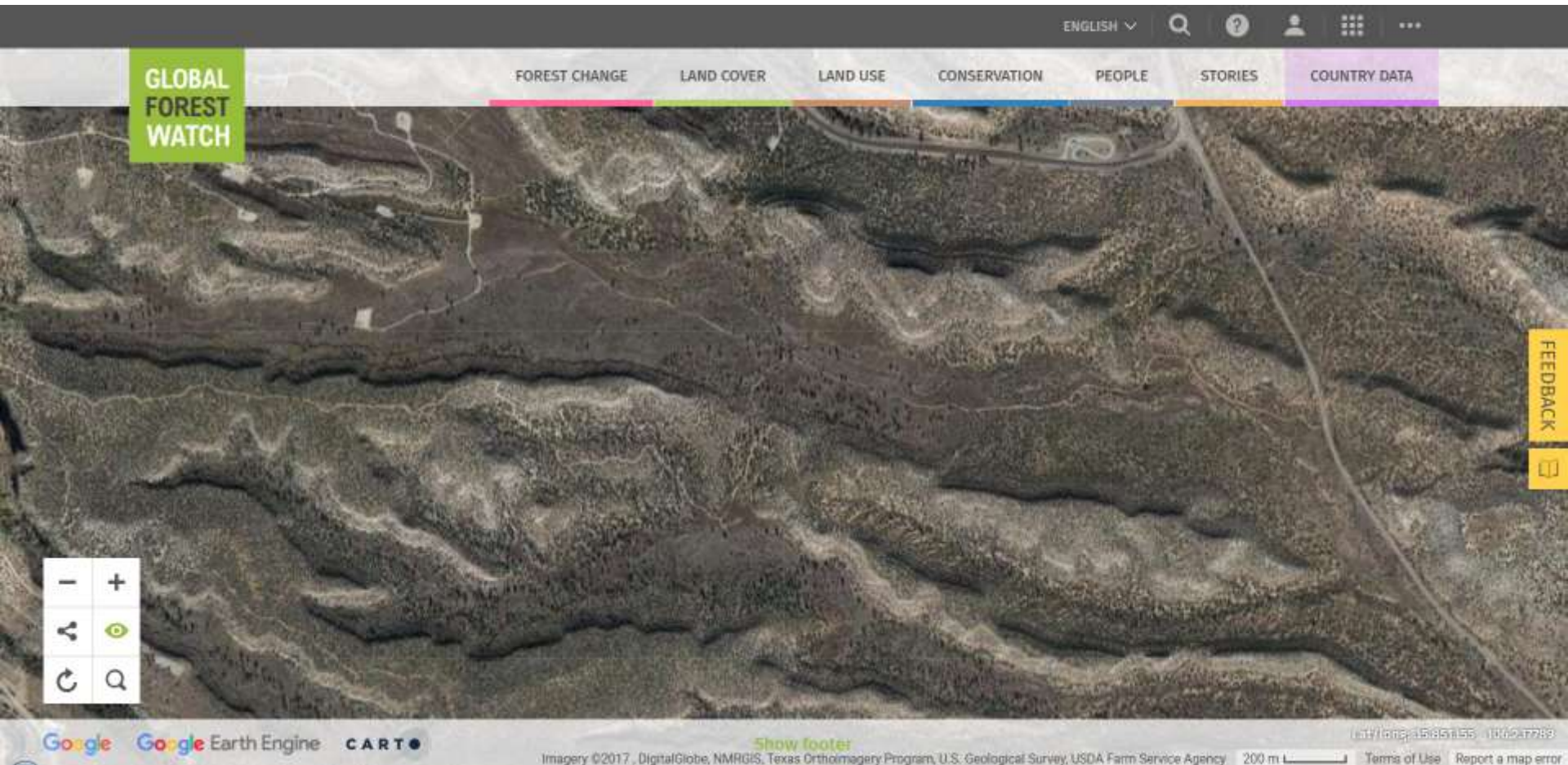
Cool, better than the human eye!



Climate change-driven mortality (US)



Physiological stress - no change detected





Tanja Sanders

Forest monitoring



Henrik Hartmann

RG Plant allocation



William (Bill) Anderegg

RG tree mortality



Cate Macinnis-Ng

Ecophysiology



Bernhard Schuldt

RG Tree hydraulics



Hans Juergen Boehmer

RG Biogeography

Crossing scales and disciplines to identify global trends in tree mortality as indicator of forest health

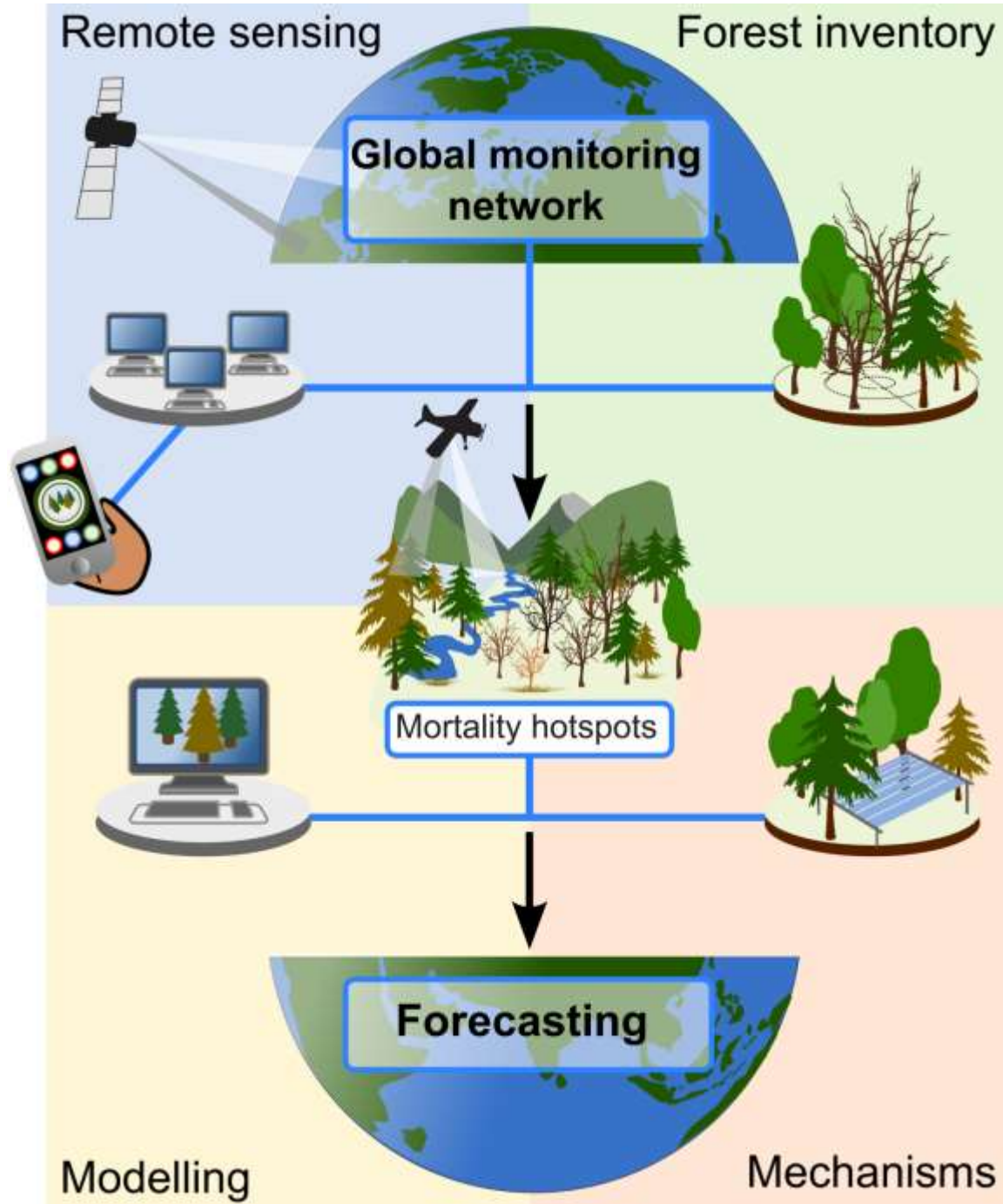


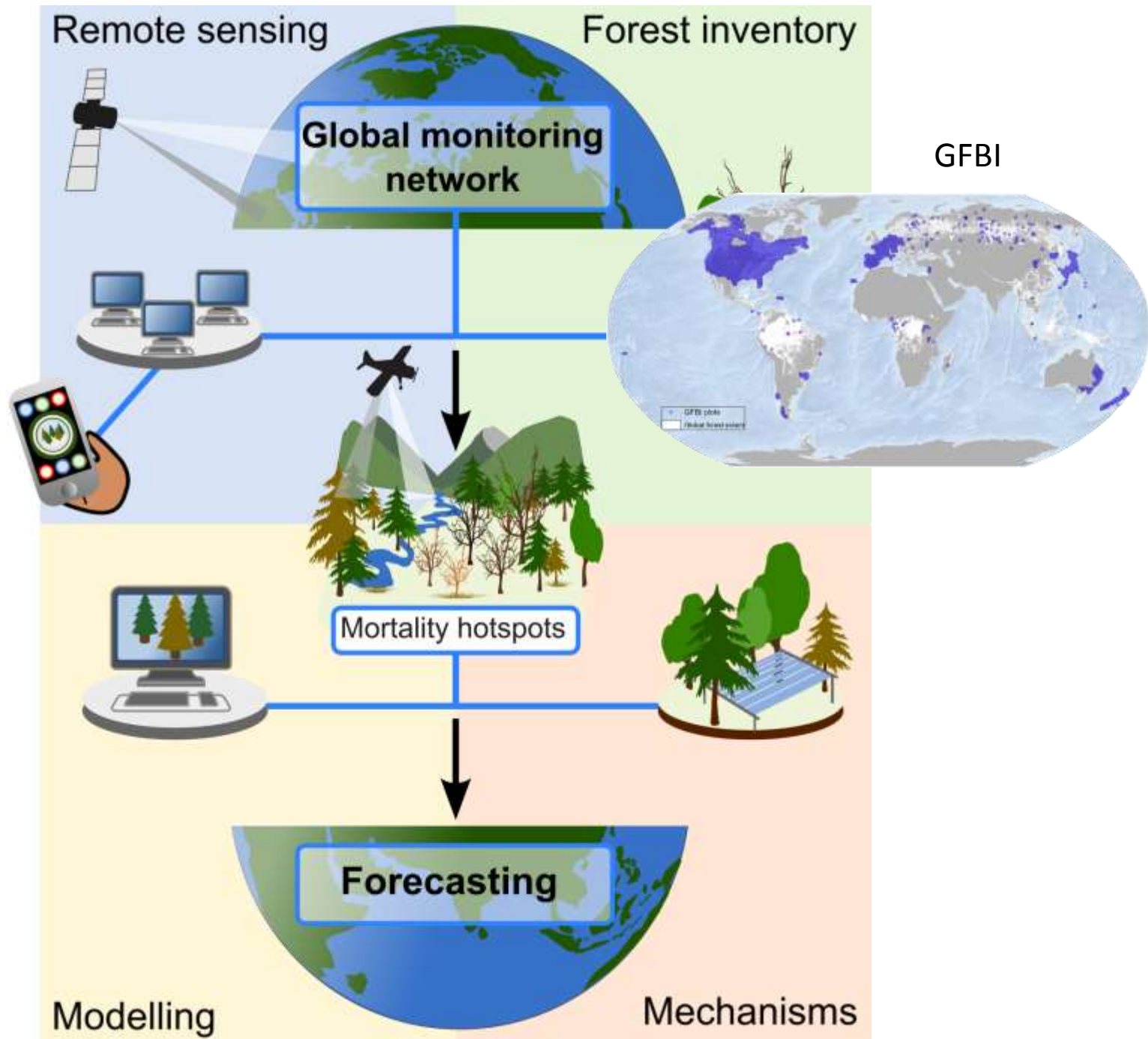
International
meeting on
tree mortality

June 21-23,
2017,
Hannover,
Germany



- 71 participants from 20 countries and six continent
- 4 (+1) major disciplines
 - Mechanisms, Remote sensing, Forest Inventory, Modeling, Citizen science





Impact of the Hanover workshop

- People get involved:
 - Tom Crowther (CH)
 - Craig Allen (US)
 - Matt Hansen (US)
 - Andreas Bolte (DE)
 - Maurizio Mencuccini (GB)
 - Sylvain Delzon (FR)
 - Jasper Bloemen (BL)
 - Mikey O'Brien (GB)
 - Jan Vesserbelt (NL)
 - Nadine Ruehr (DE)
 - ...

A global monitoring network of tree mortality

- Working groups
 - **Remote-sensing**
 - Develop real-time assessment tools
 - **Inventory of inventories**
 - Meta-data about forest inventories and plot networks with relevant data
 - **Monitoring requirements**
 - Plant traits for stress assessment and mortality cause attribution
 - **Webpage and network establishment**
 - Embedment into existing structures (e.g. IUFRO task force)
- More information
 - Upcoming NP meeting report
 - Strategy paper

You got data on tree status?

Crossing scales and disciplines to identify global trends in tree mortality as indicator of forest health



International network on monitoring global tree mortality



NEWS

WORKSHOPS

SURVEY

Thank you for your interest in becoming part of the tree mortality network. Please use the link below to take our survey and provide information on your monitoring or inventory.

Coordinates provided by an upload will appear as dots on the world map. With you help showing soon the global extend of the initiative to understand tree mortality.

[Click here to take the survey](#)



Questions, comments, suggestions



Global monitoring initiative
www.tree-mortality.net

Contact - Henrik Hartmann
hhart@bgc-jena.mpg.de