Chesapeake Hypoxia Analysis & Modeling Program (CHAMP):

Predicting impacts of climate change on the success of management actions in reducing Chesapeake Bay hypoxia.

Fall 2016 – Fall 2021
NOAA funded: ~$1.4M

Chesapeake Hypoxia Analysis & Modeling Program (CHAMP)

PIs:

Marjorie Friedrichs (VIMS)
Lewis Linker (CBP/EPA)
Gary Shenk (CBP/USGS)
Ray Najjar (PSU)
Hanqin Tian (Auburn)
Eileen Hofmann (ODU)

Investigators:

Ike Irby (VIMS)
Kyle Hinson (CBP → VIMS)
Ping Wang (CBP)
Richard Tian (CBP)
Gopal Bhatt (CBP)
Maria Herrmann (PSU)
Bowen Zhang (Auburn)
Yuanzhi Yao (Auburn)
Scott Ator (USGS)

CHAMP goals

Develop a Chesapeake Bay scenario-forecast modeling system to:

- Estimate the impacts of future changes in climate and anthropogenic nutrient inputs on the spatial/ temporal extent of hypoxia in Chesapeake Bay

- Determine whether mandated nutrient reductions (i.e. the WIPs/TMDLs) will successfully reduce hypoxia and meet WQS under future climate conditions

→ An opportunity for academic research to impact management decisions!

CHAMP MTAG

NOAA RFP requirement:

- PIs will engage local, state, and/or federal agency representatives on a Management Transition Advisory Group (MTAG)
- The MTAG will meet with the PIs annually to evaluate progress and suitability to hypoxia management goals
- The MTAG will make recommendations to the project on how to make the research most applicable to hypoxia management

CHAMP MTAG

Current Members:

Lew Linker (ex-officio) - EPA, CBPO
Gary Shenk (ex-officio) - USGS, CBPO
Lee Currey - MDE
Bruce Michael - Maryland DNR
James Davis-Martin - Virginia DEQ
Beth McGee - CBF
Mark Bennett - USGS
Becky Baltes - NOAA/IOOS
Rich Batiuk - EPA
Zoe Johnson - NOAA CBO
Susan Julius - EPA

CHAMP methods

STAC →

- **Multiple models**
- **Climate change**
- **Uncertainty**

CHAMP methods

Using *multiple models* in the Chesapeake modeling system:

- Three watershed models:
  - CBP WSMp6 (**CBP**)
  - DLEM (**Auburn**)
  - Sparrow (**USGS**)

} **Up to six model combinations**

- Two estuarine models:
  - CBP WQSTM (**CBP**)
  - ChesROMS-ECB (**VIMS**)

- Oyster population model (**ODU**)
  - To examine impact of hypoxia on living resources

CHAMP climate simulations

Four types of watershed+estuarine simulations:

- Realistic hindcast (1985-2016)
- Future simulation (2017-2050)
- Sensitivity simulations (2017-2020; 2047-2050)
  varying levels of climate change vs.
  varying levels of nutrient reduction
- Decision support: alternative management scenarios

CHAMP forcing fields

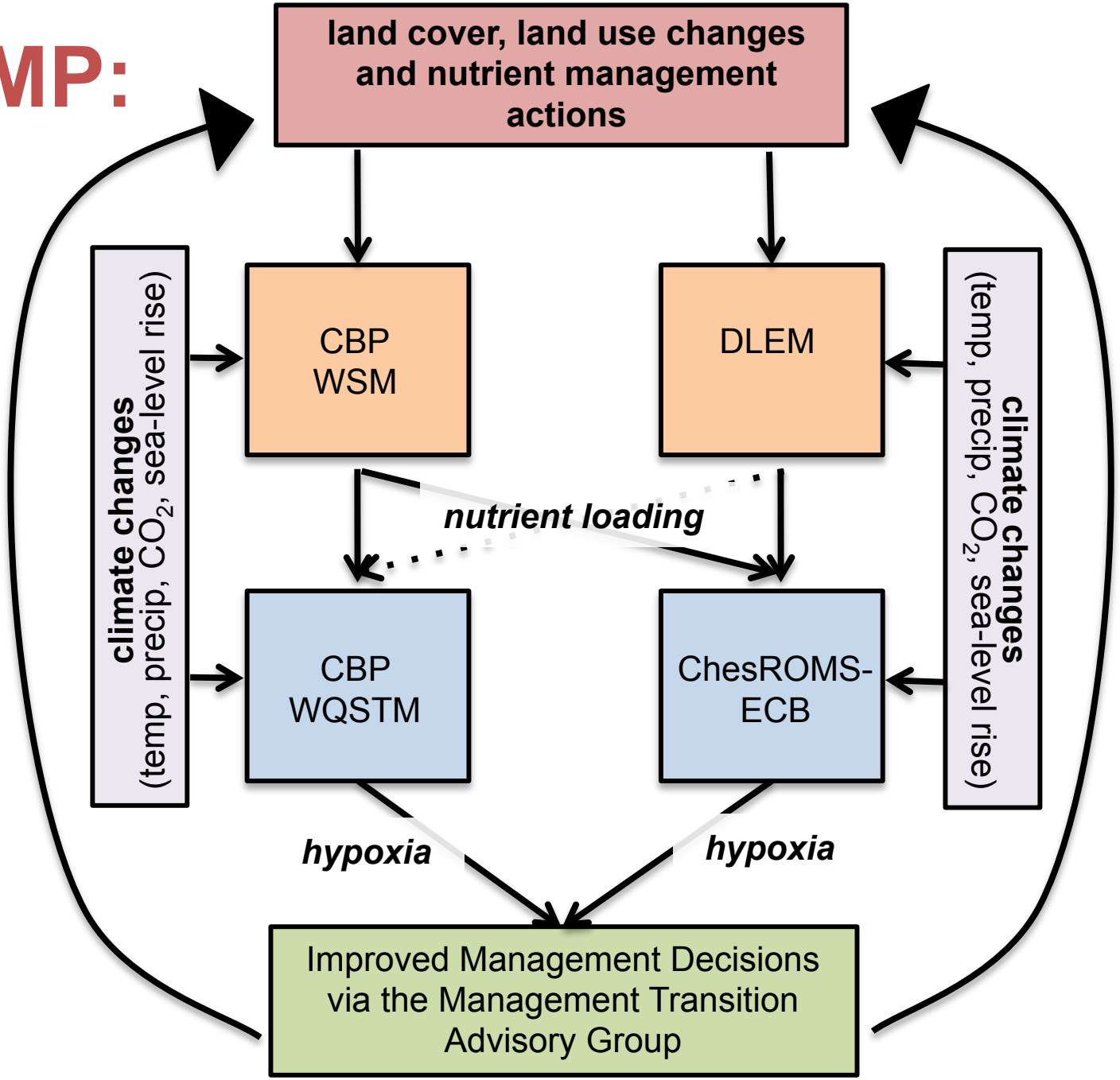
Forcing fields for Future Simulations:

For an “apples to apples comparison” all model combinations will eventually use same future forcing fields:

- Temperature, Precipitation, Winds, Humidity (**Najjar**)
- Land use Projections (**Claggett/Shenk**)
- Future Atmospheric Deposition (**Bash**)

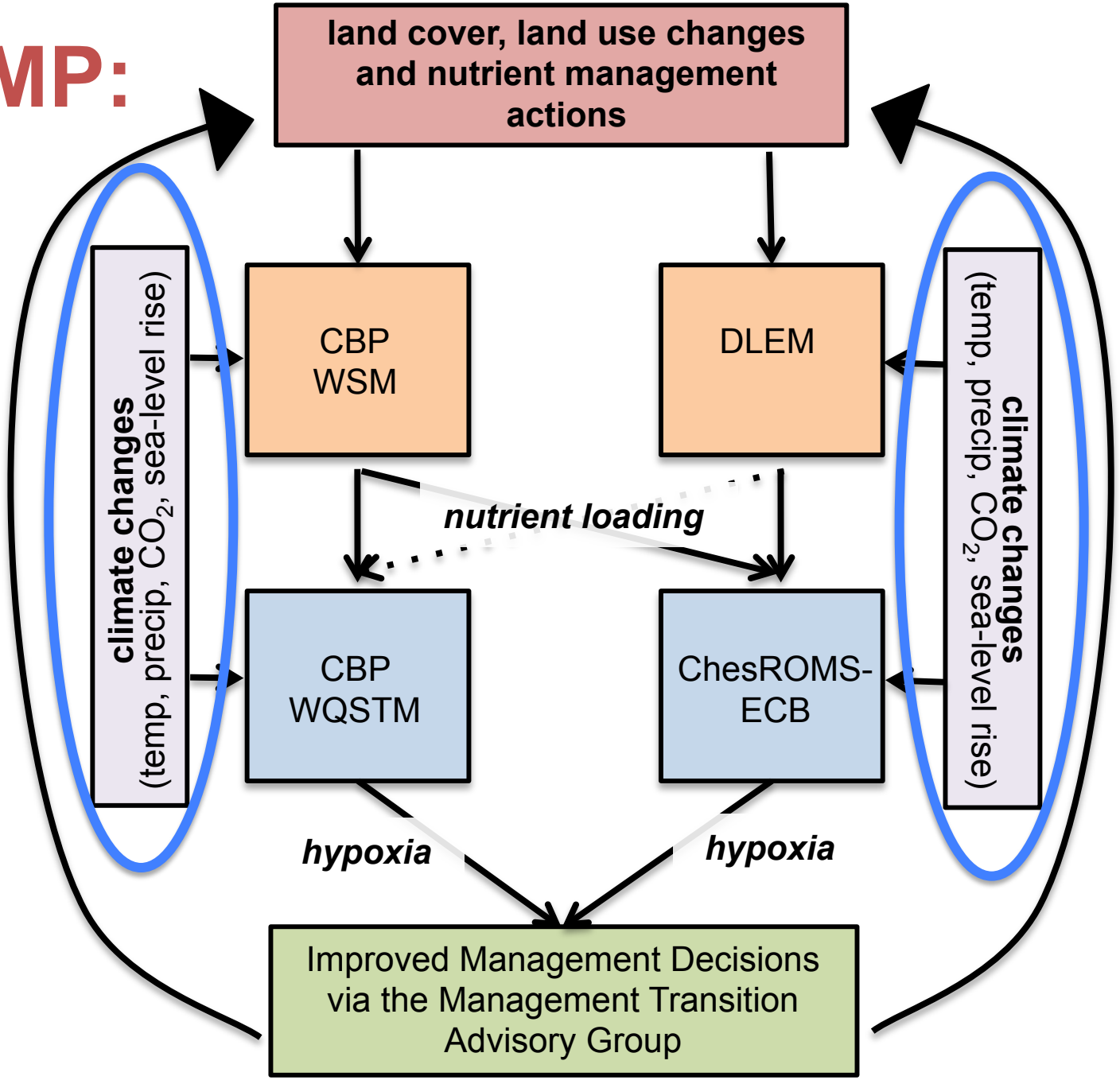
(CBP is assembling CHAMP website where all forcing will be available, for use by other research teams as well.)

CHAMP:


land cover, land use changes and nutrient management actions
climate changes (temp, precip, CO_2, sea-level rise)
CBP WSM
DLEM
climate changes (temp, precip, CO_2, sea-level rise)
nutrient loading
CBP WQSTM
ChesROMS-ECB
hypoxia
hypoxia
Improved Management Decisions via the Management Transition Advisory Group

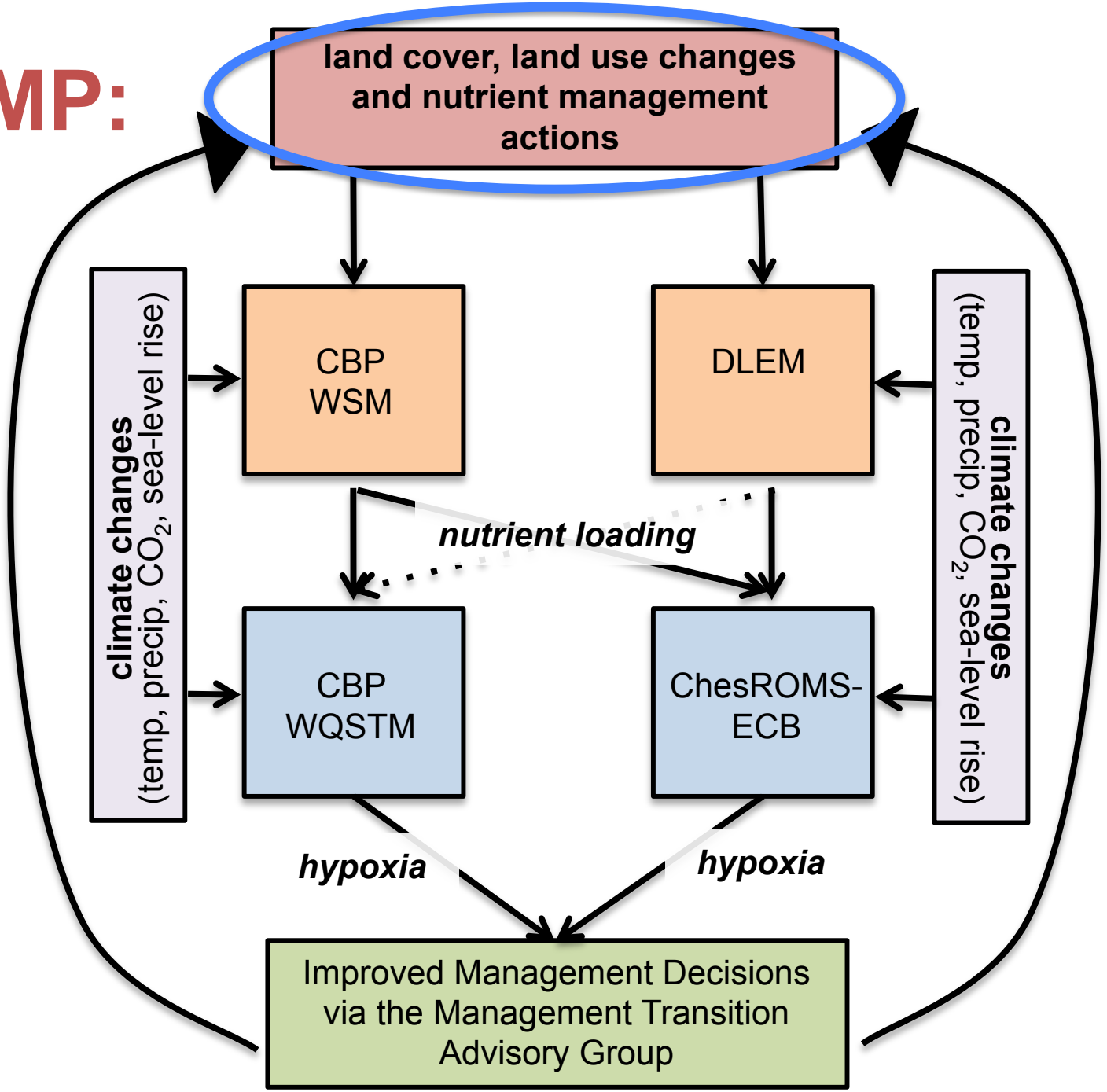
CHAMP:

Ray Najjar



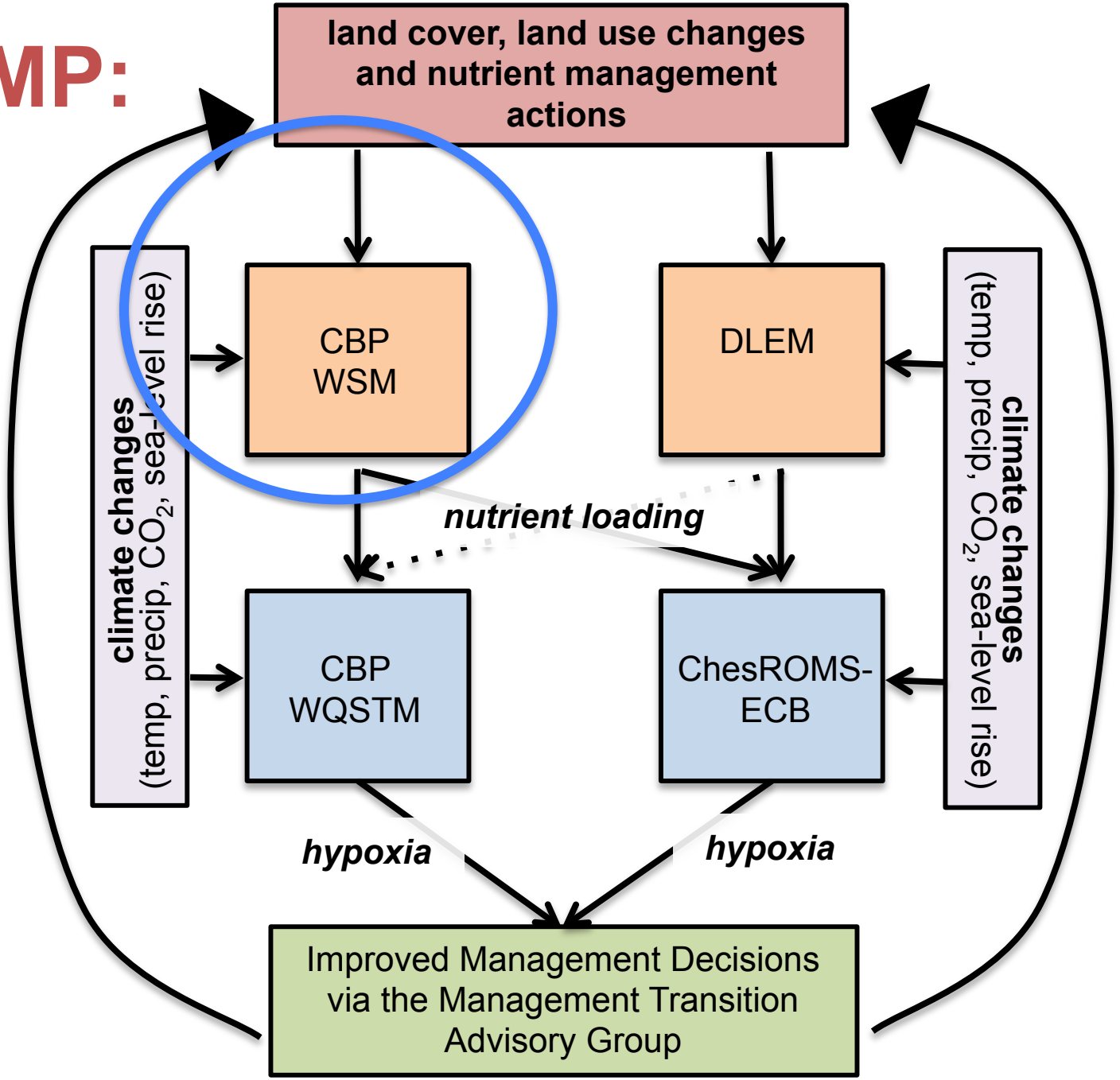
CHAMP:

Peter Claggett



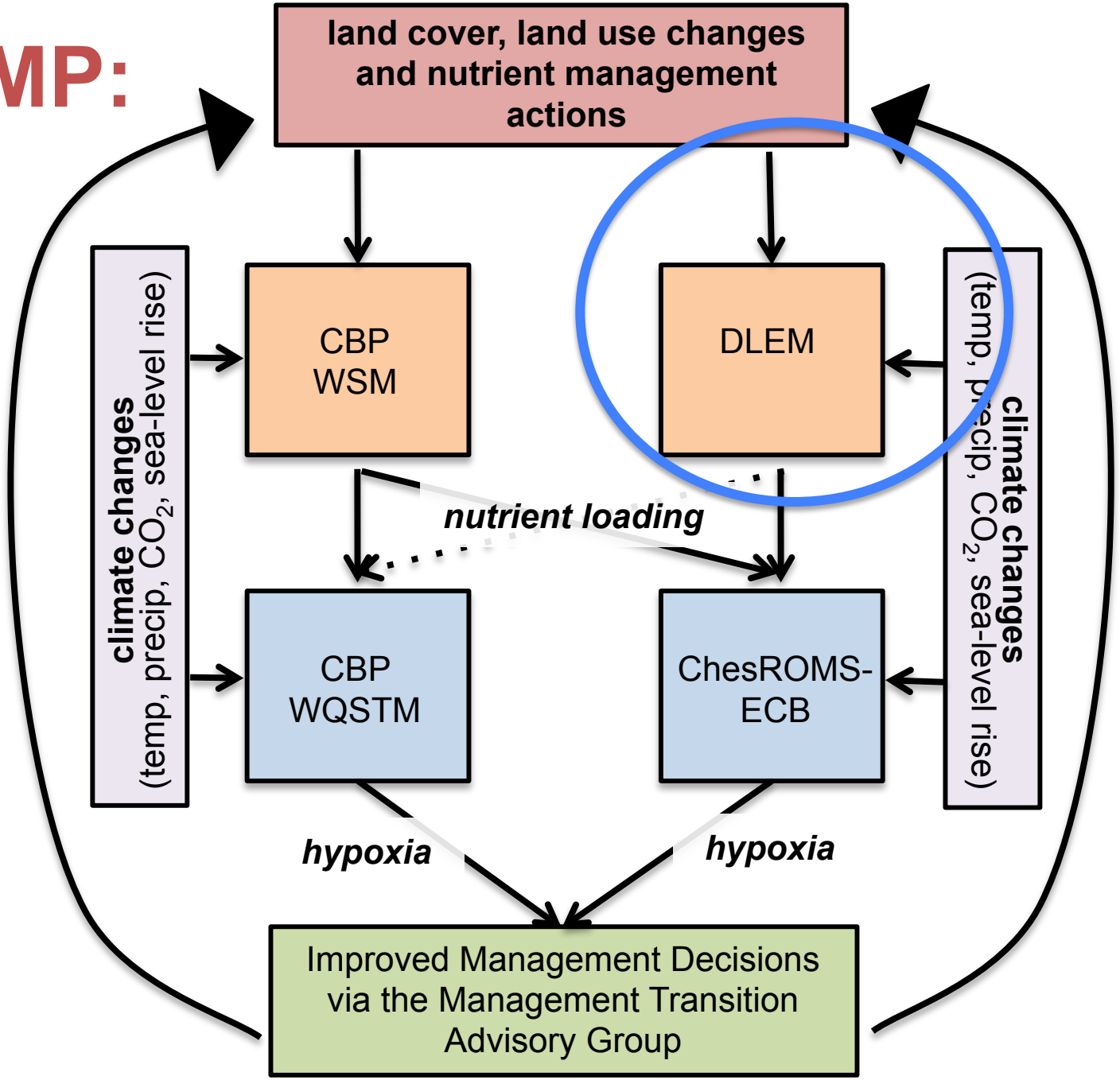
CHAMP:

Gary Shenk



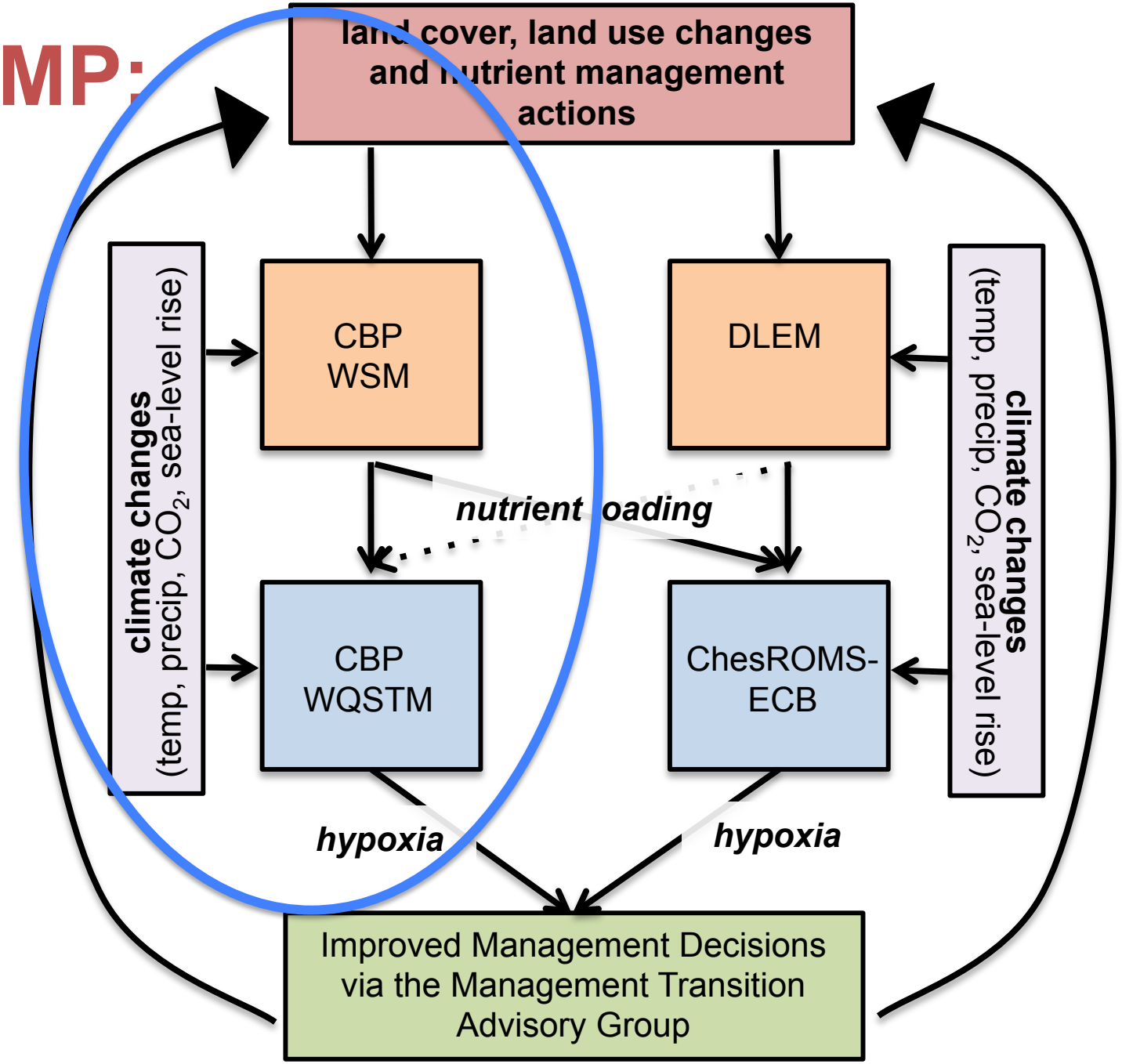
CHAMP:

Hanqin Tian



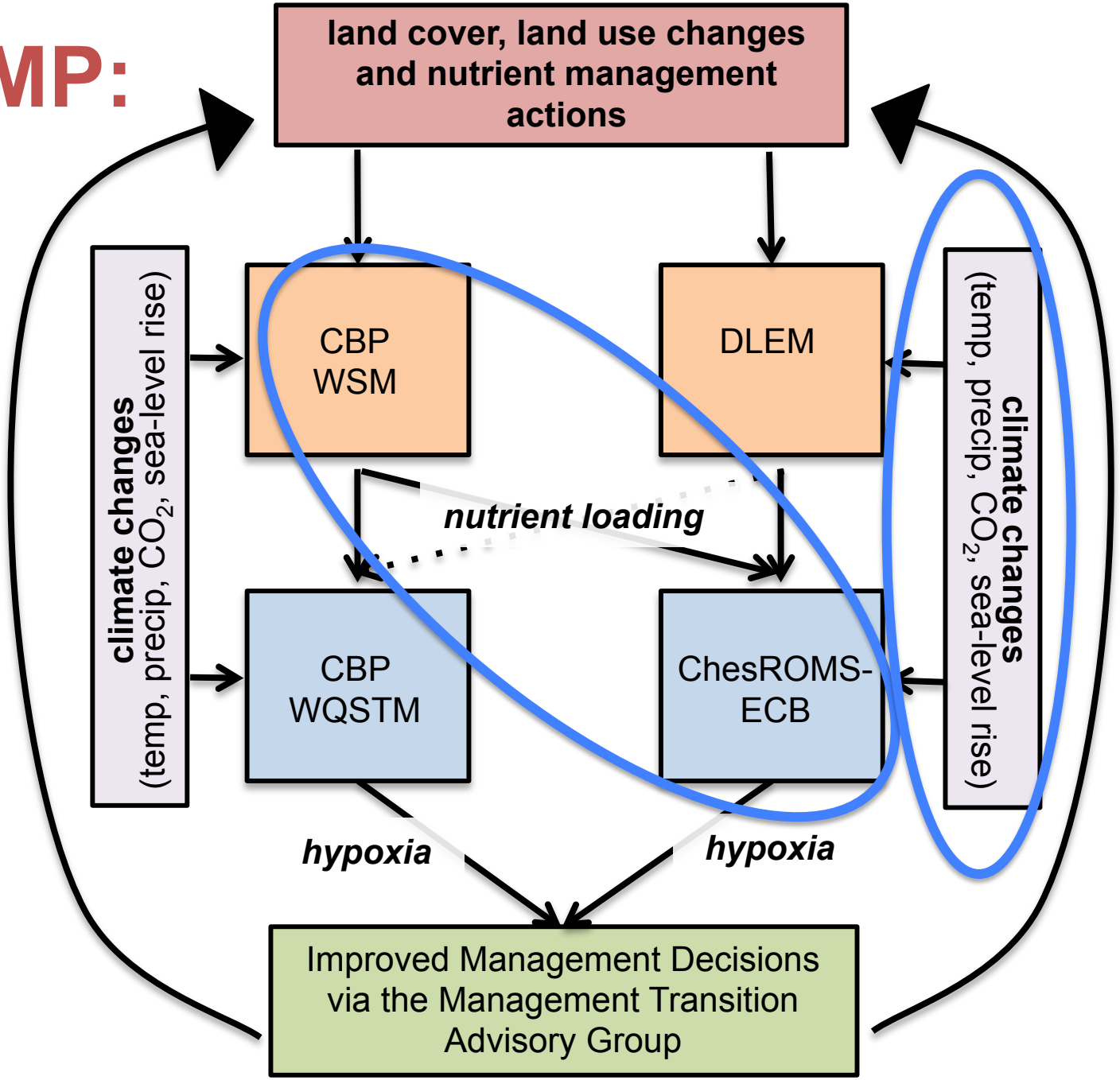
CHAMP:

Lew Linker



CHAMP:

Ike Irby



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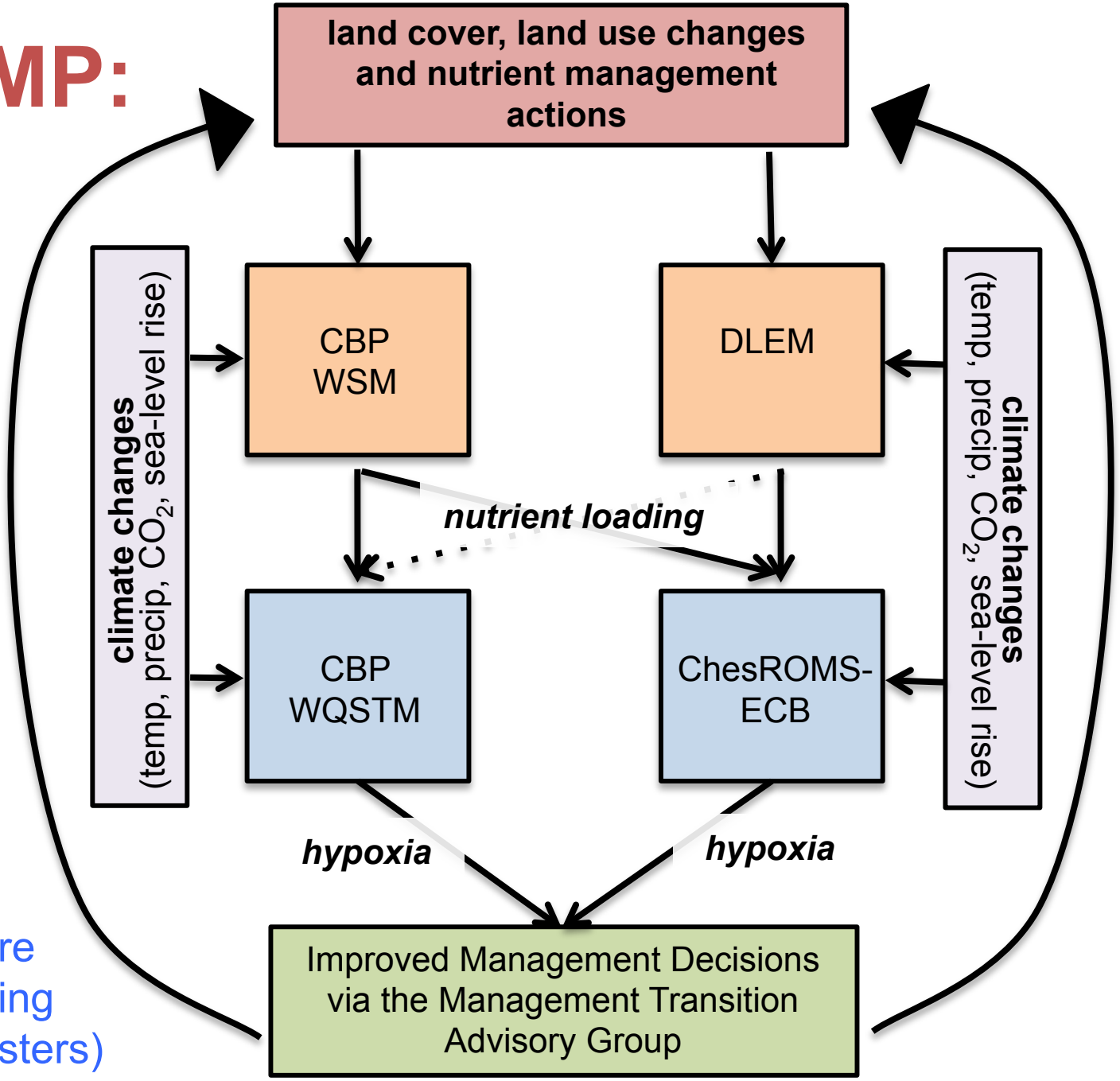
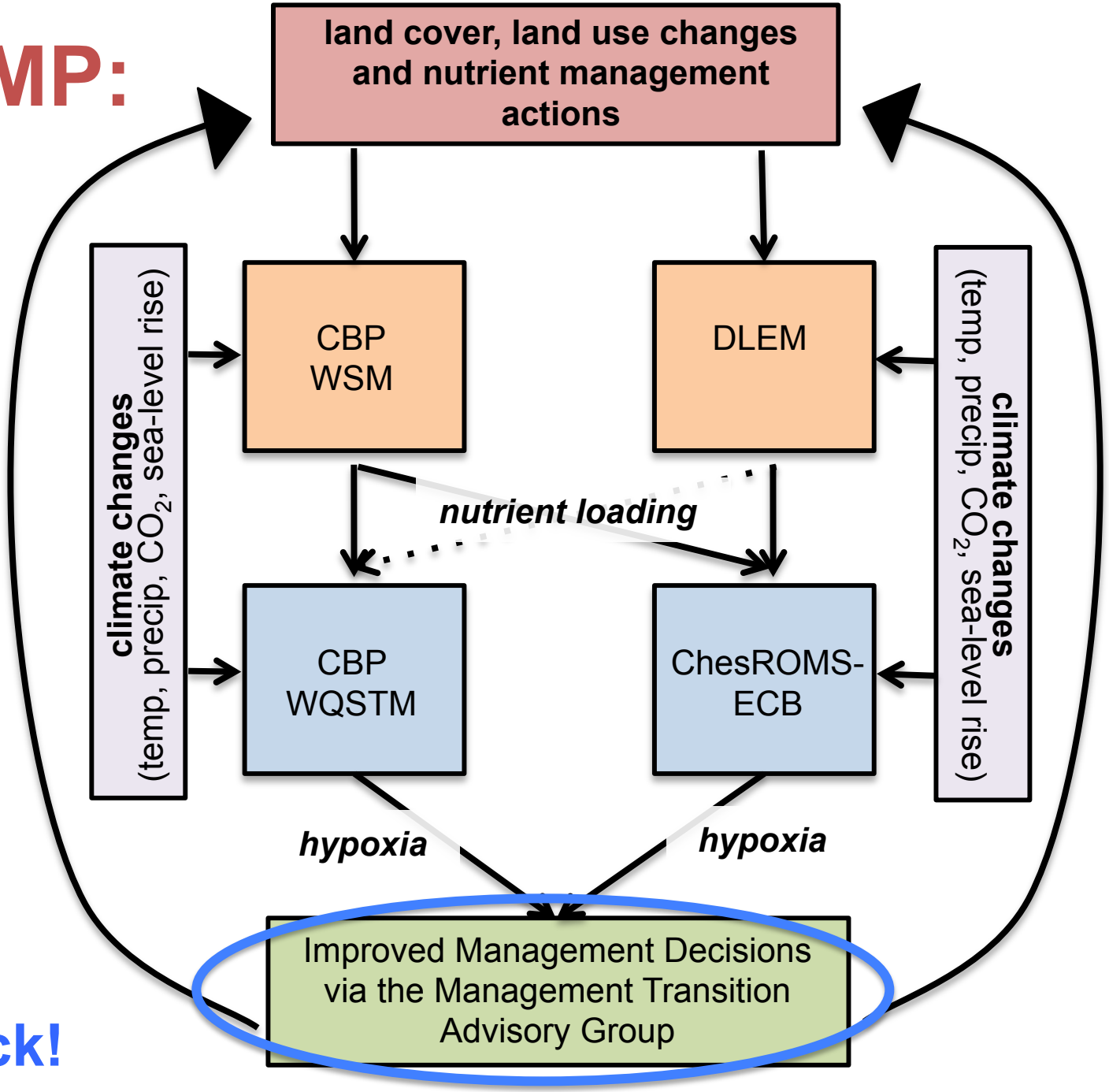


Eileen Hofmann

Impact of future hypoxia on living resources (oysters)

CHAMP:



MTAG Feedback!