Building Capacity for Biodiversity and Human Health

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SKLID
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State Key Laboratory for Infectious Disease Prevention and Control

What do we concern for biodiversity and human health?
——health sector's perspective

- Health benefits of biodiversity
- Health risks of biodiversity

Hypothesis for biodiversity and human health

- Nonlinear effects of biodiversity on human health
  - Positive – health benefits
  - Negative – health risks
  - More positive than negative

Strategic plan for biodiversity and human health

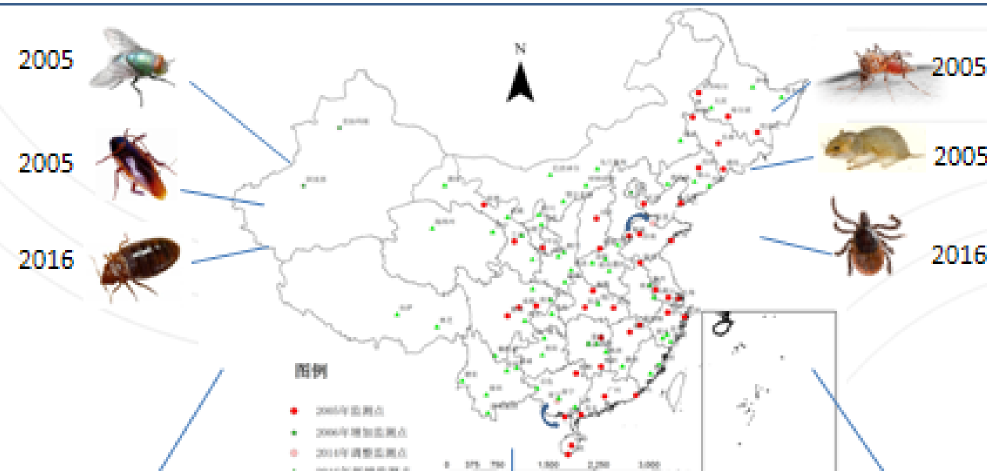
- Maximize the positive effects (health benefits) of biodiversity

- Minimize the negative effects (health risks) of biodiversity

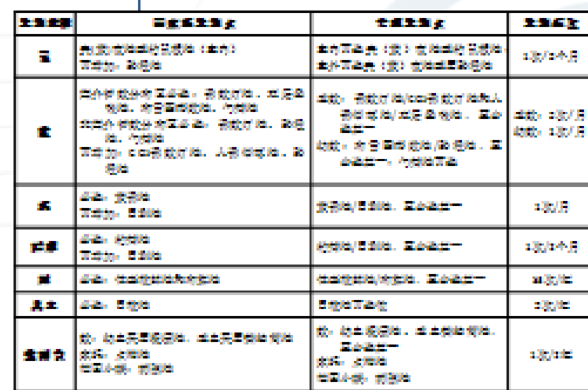
Road map for biodiversity and human health

- Surveillance and data integration
- Assessment on the effects of biodiversity
- Public health action for risk communication and risk management
- Public health action to maximize the benefits
- Minimize the impacts of public health action on biodiversity as much as possible

Web-based Platform of National Vectors Surveillance Networks

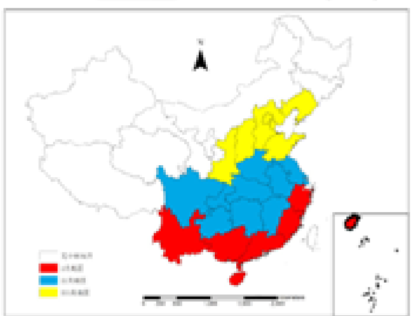


2016年全国病媒生物监测点分布图



2016年全国病媒生物监测方案要点

全国重要病媒生物抗药性监测点分布图



登革热媒介伊蚊监测省份分布图

全国登革热国家级监测点分布图

全国登重要病媒生物监测系统（网络）

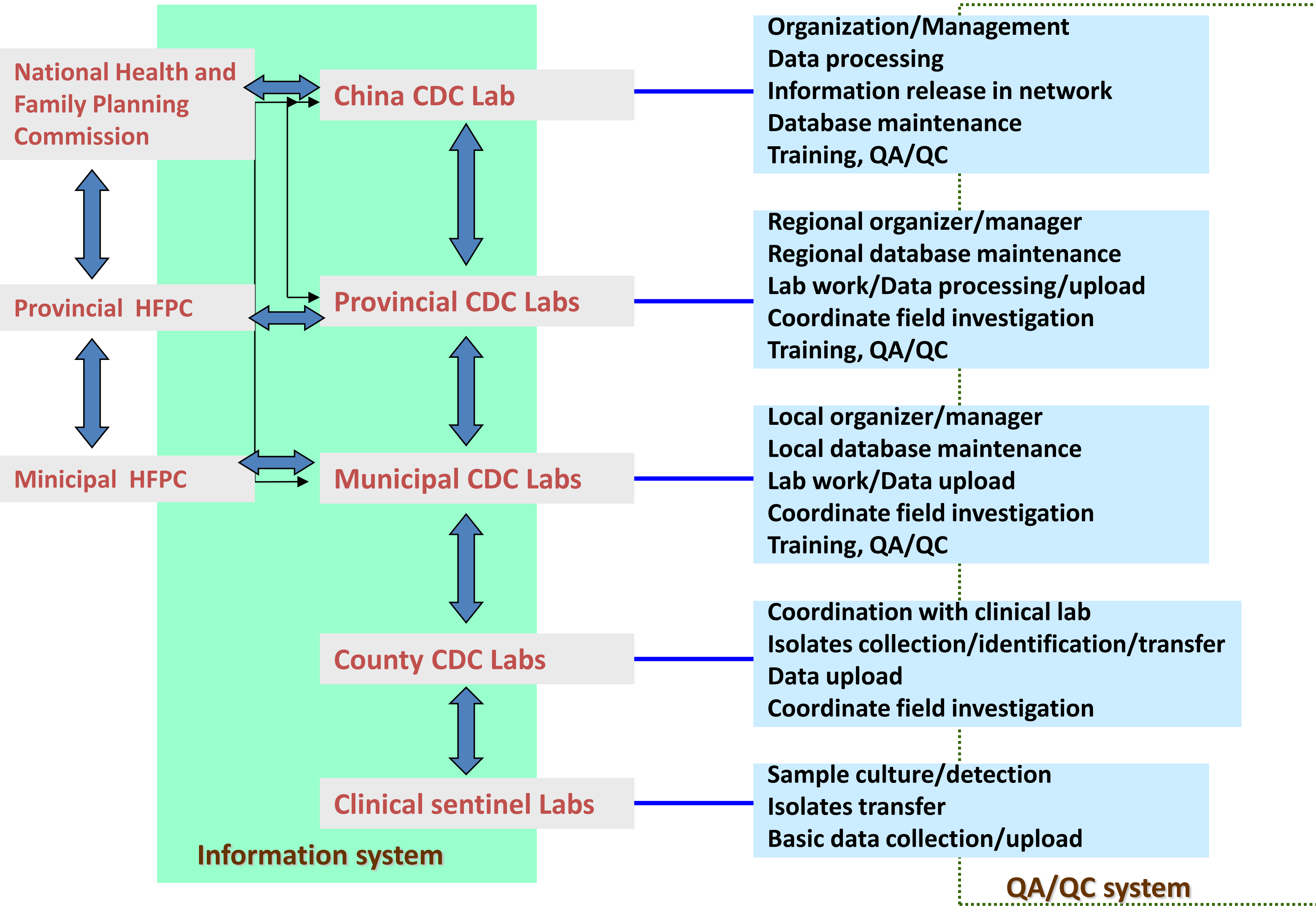
Chinese Pathogen Identification Net

(China PIN)

Identify pathogens, Identify outbreaks, Identify outbreaks

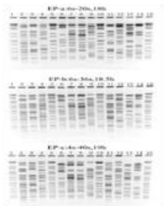
The national laboratory-based surveillance network for bacterial pathogens

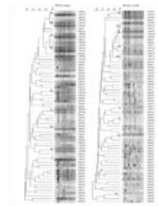
China PIN


National Health and Family Planning Commission
China CDC Lab
Organization/Management
Data processing
Information release in network
Database maintenance
Training, QA/QC
Provincial HFPC
Provincial CDC Labs
Regional organizer/manager
Regional database maintenance
Lab work/Data processing/upload
Coordinate field investigation
Training, QA/QC
Minicipal HFPC
Municipal CDC Labs
Local organizer/manager
Local database maintenance
Lab work/Data upload
Coordinate field investigation
Training, QA/QC
County CDC Labs
Coordination with clinical lab
Isolates collection/identification/transfer
Data upload
Coordinate field investigation
Clinical sentinel Labs
Sample culture/detection
Isolates transfer
Basic data collection/upload
Information system
QA/QC system

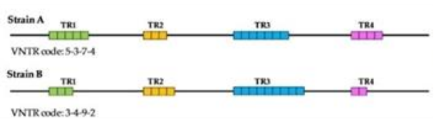
Technology

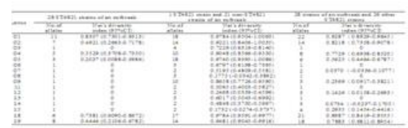
脉冲场凝胶电泳分析（PFGE）

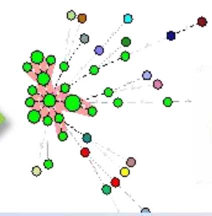




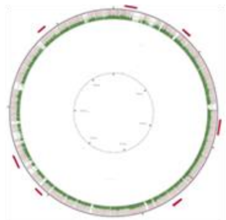
多位点可变数串联重复序列分析（MLVA）

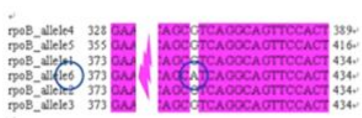




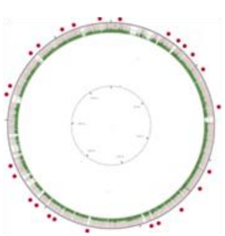


多基因位点测序列分型（MLST或PLST）

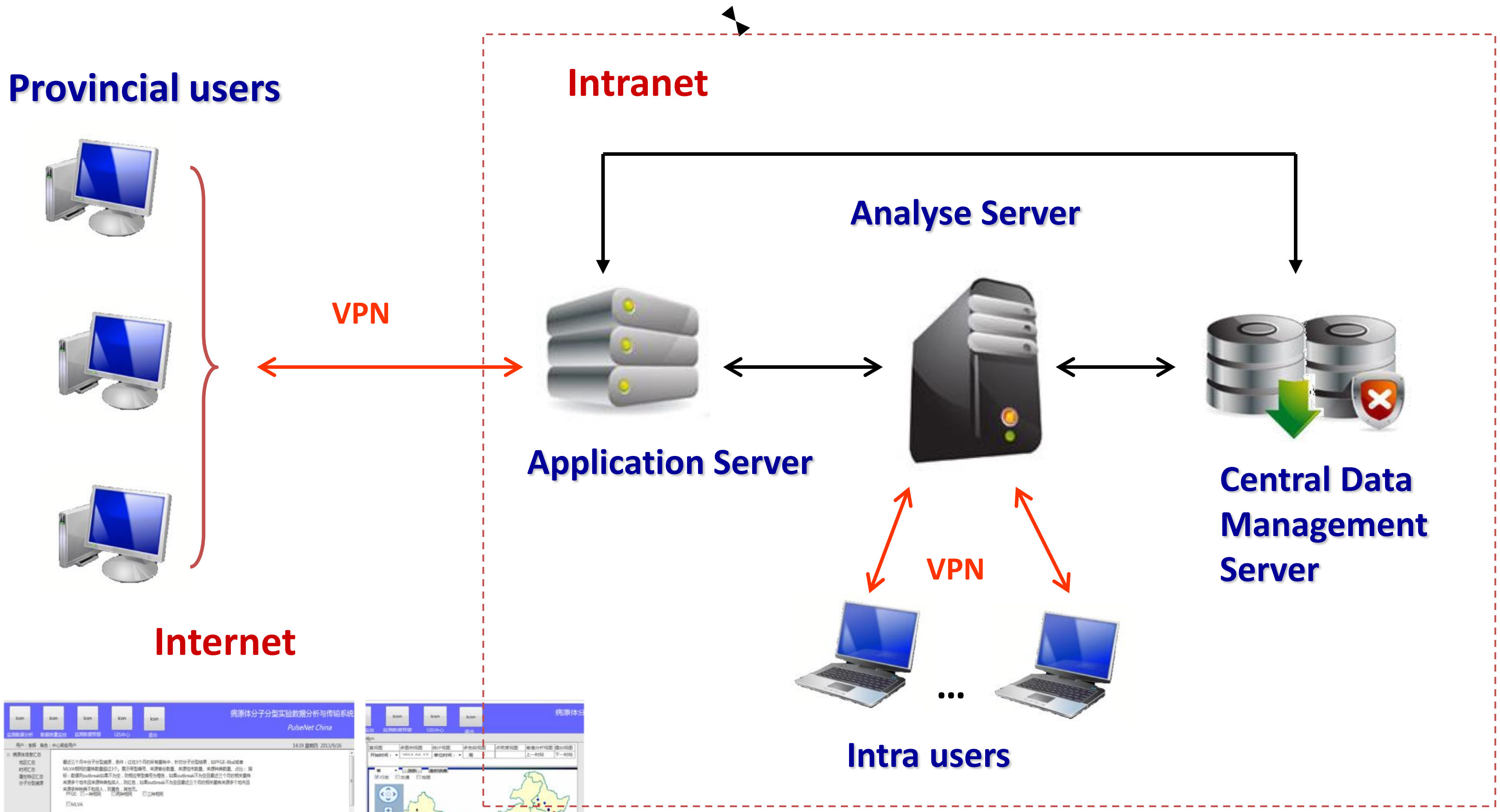


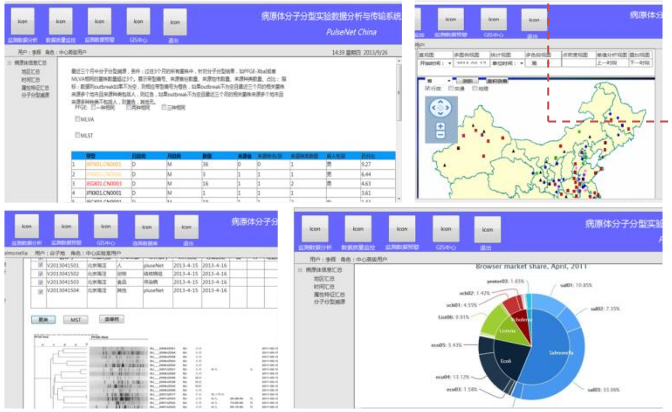


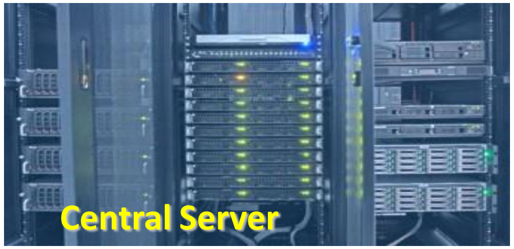
基于全基因组测序分型 (Genome sequencing)



Information System

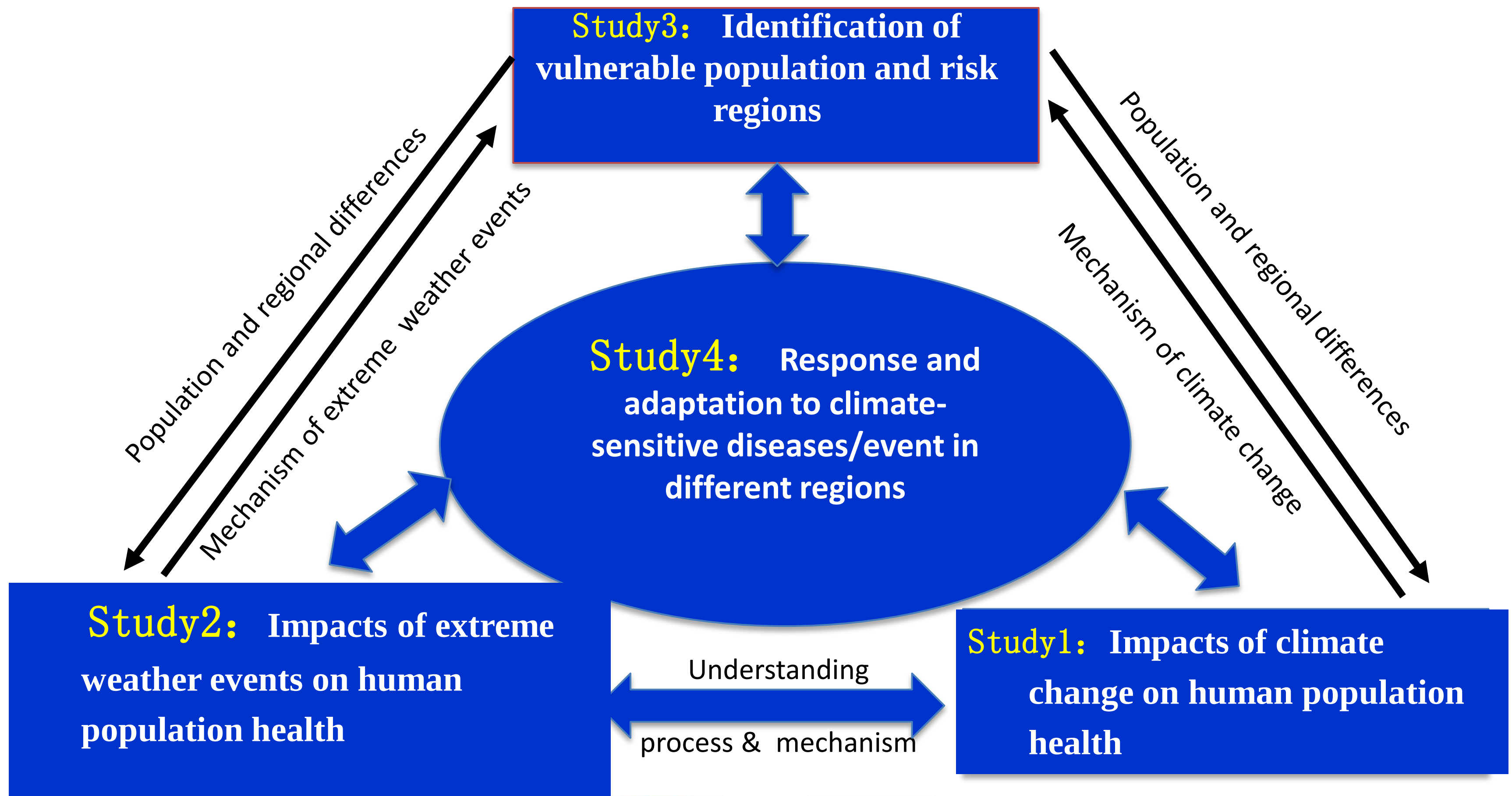






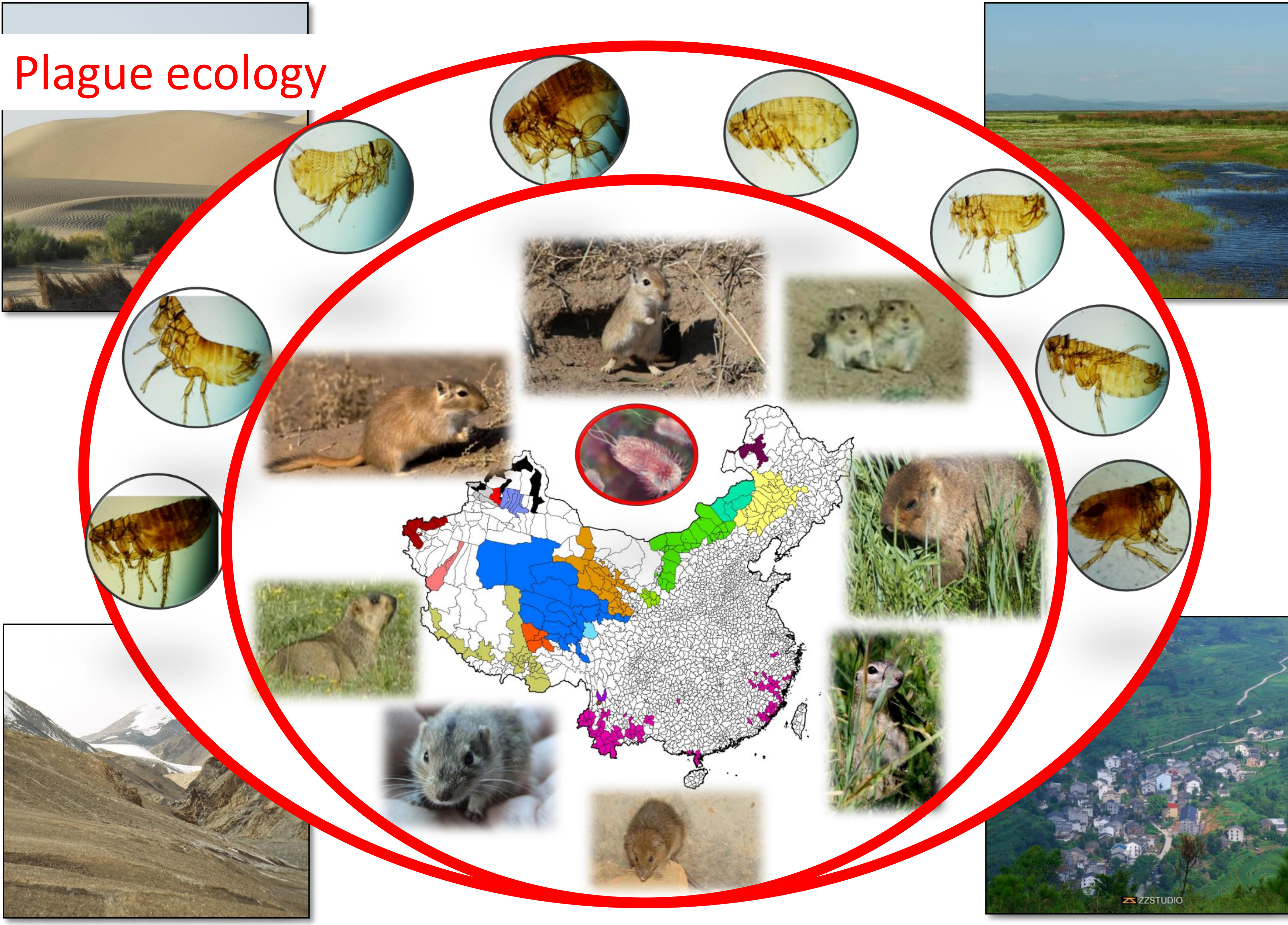
National Basic Research Program of China(2012CB95550)

Climate change impacts on health and adaptation mechanism



中国疾病预防控制中心　北京师范大学　中国科学院地理资源所　中国科学院微生物所　国家气候中心　山东大学

Plague ecology



Plague in China

- Central Asia: positive
- Vietnam: negative
- WHY this difference?


PNAS

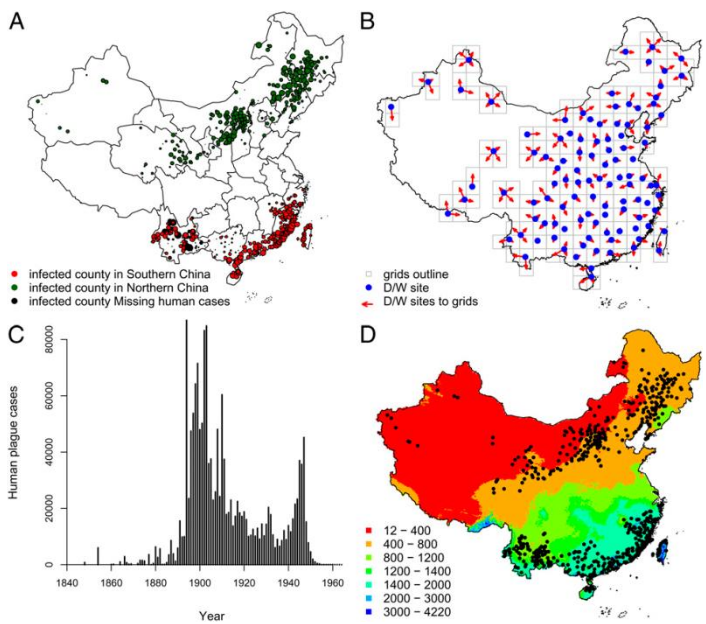
Nonlinear effect of climate on plague during the third pandemic in China

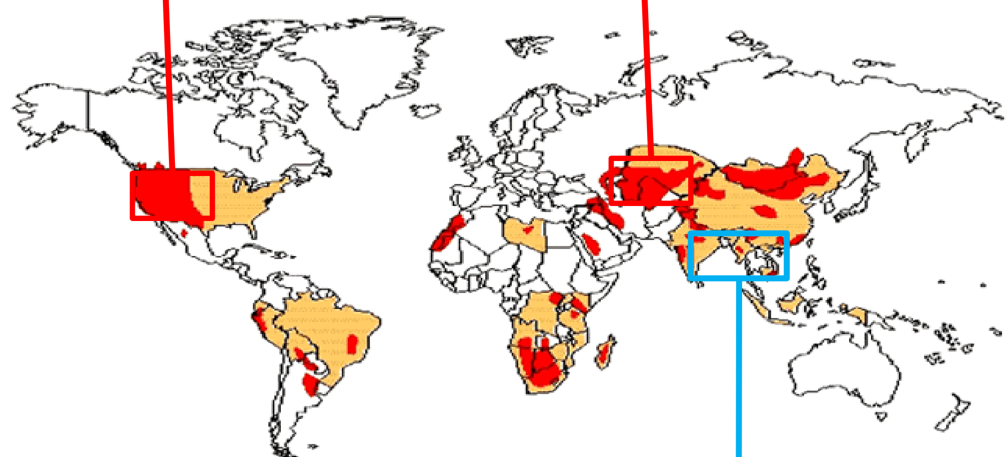
Lei Xu[a,b,1], Qiyong Liu[c,1], Leif Chr. Stige[d], Tamara Ben Ari[d], Xiye Fang[e], Kung-Sik Chan[f], Shuchun Wang[e,2], Nils Chr. Stenseth[d,2], and Zhibin Zhang[a,2]

[a]State Key Laboratory of Integrated Management on Pest Insects and Rodents, Institute of Zoology, Chinese Academy of Sciences, Beijing 100101, China; [c]State Key Laboratory for Infectious Diseases Prevention and Control, National Institute for Communicable Disease Control and Prevention, Chinese Centre for Disease Control and Prevention, Beijing 102206, China; [d]Centre for Ecological and Evolutionary Synthesis, Department of Biology, University of Oslo, Blindern, 0316 Oslo, Norway; [e]National Institute for Communicable Disease Control and Prevention, Chinese Centre for Disease Control and Prevention, Beijing 102206, China; [f]Department of Statistics and Actuarial Sciences, University of Iowa, Iowa City, IA 52242; and [b]Graduate University of Chinese Academy of Sciences, Beijing 100049, China

U.S.A：Parmenter et. al. ，1999； Enscore et.al.，2002)
Kazakhstan： (Stenseth,2006；Kausrud,2007；2010)

1





Viatan：(Cavanaugh,1972；Pham,2009)

Plague in China

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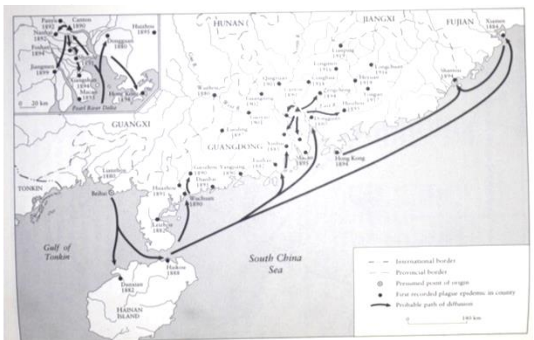
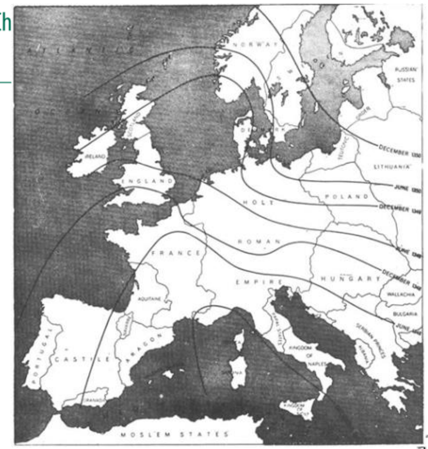
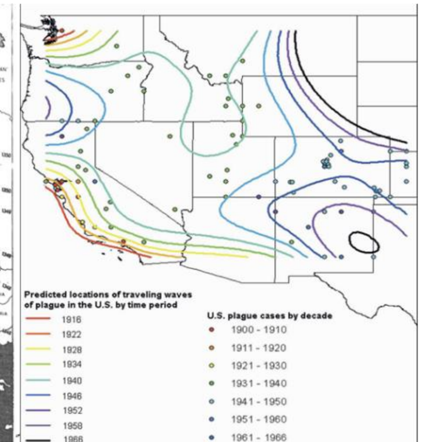
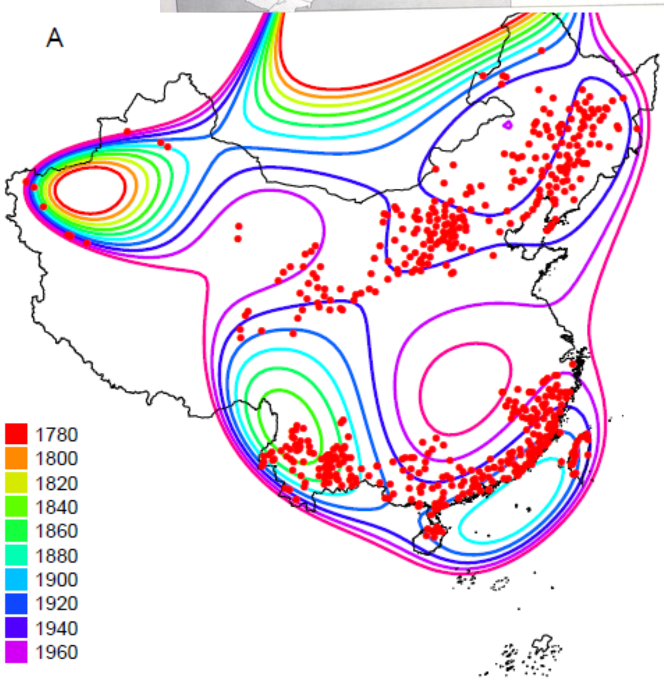
Wet climate and transportation routes accelerate spread of human plague

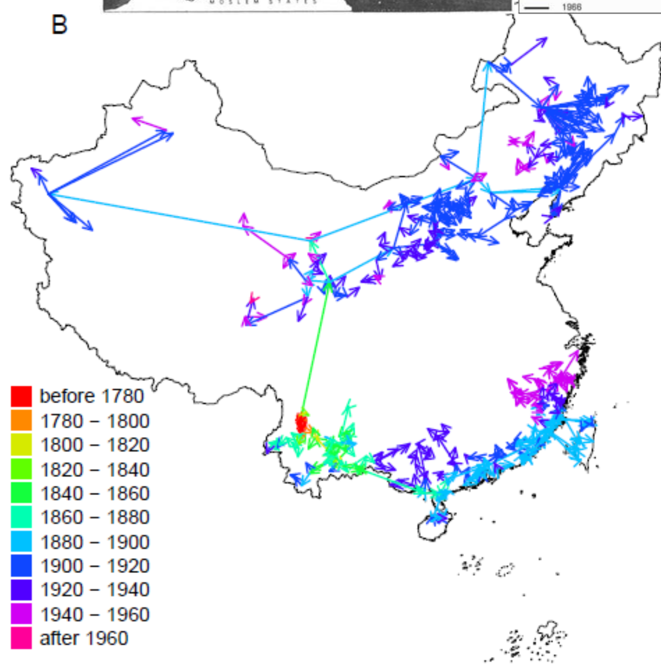
Lei Xu[1,2], Leif Chr. Stige[2], Kyrre Linné Kausrud[2], Tamara Ben Ari[2], Shuchun Wang[3], Xiye Fang[3], Boris V. Schmid[2], Qiyong Liu[3], Nils Ch
and Zhibin Zhang[1]











Plague in China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Research

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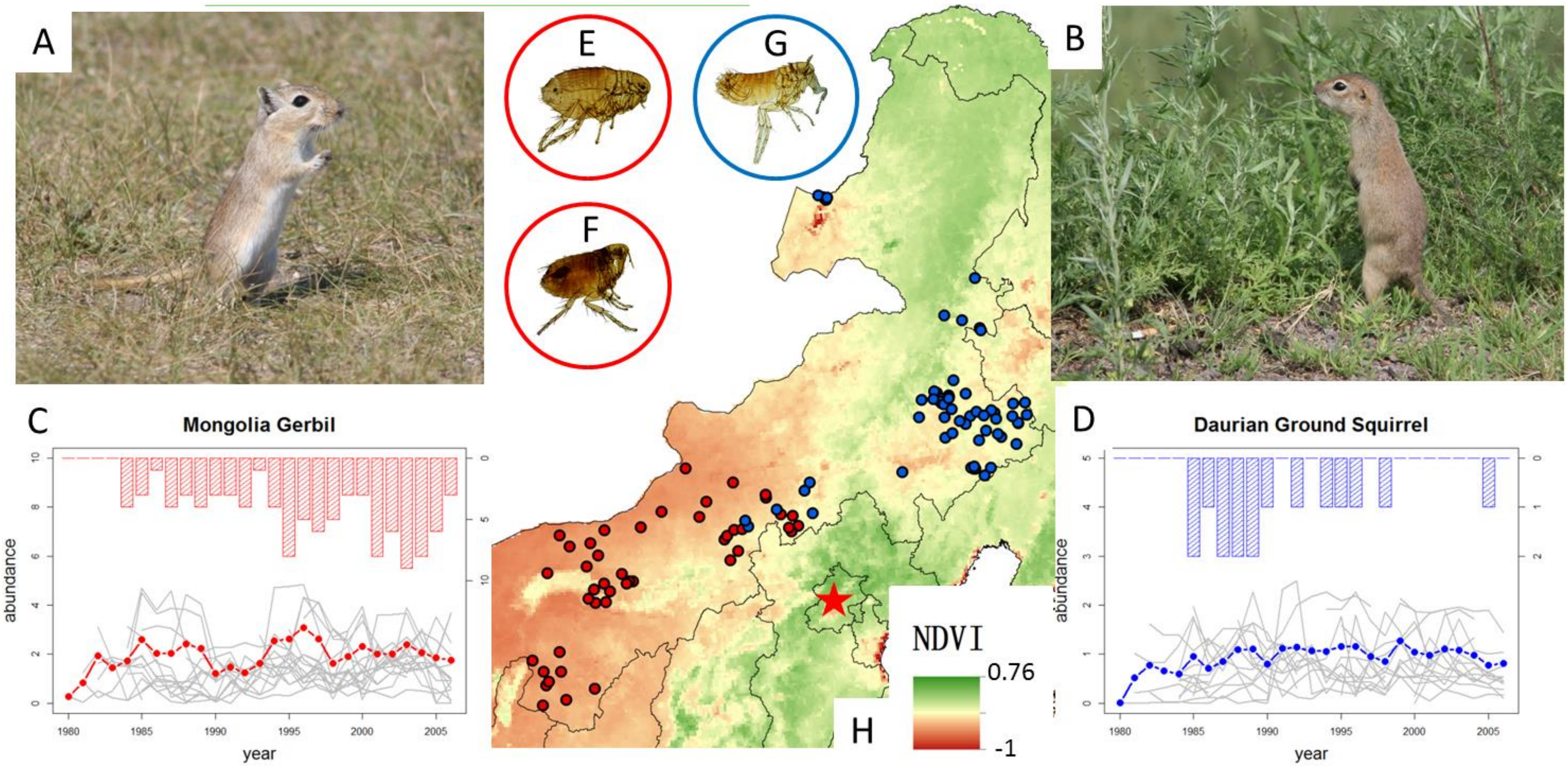
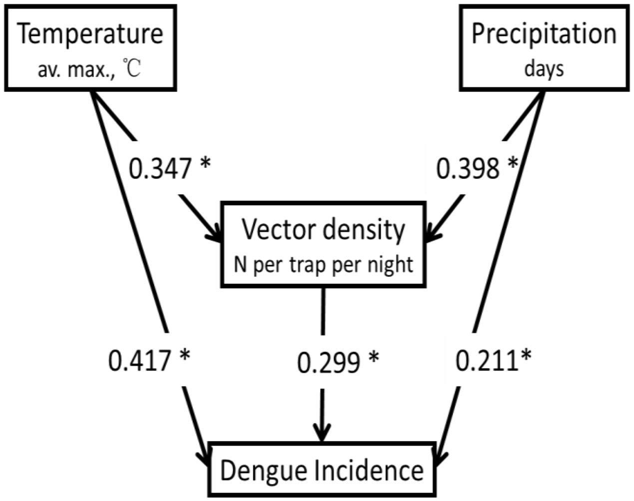
The trophic responses of two different rodent–vector–plague systems to climate change

Lei Xu[1], Boris V. Schmid[2], Jun Liu[3], Xiaoyan Si[3], Nils Chr. Stenseth[2] and Zhibin Zhang[1]

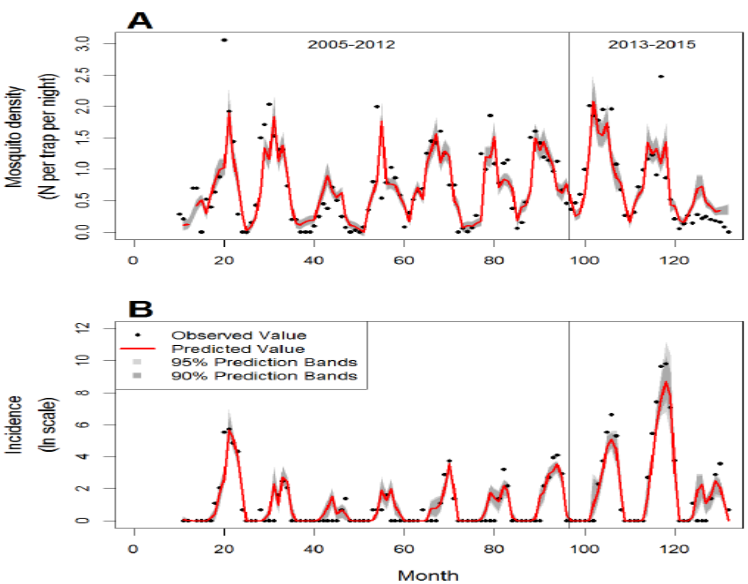


Plague surveillance locations for the Mongolian gerbil natural plague foci and the Daurian ground squirrel natural plague foci in Inner Mongolia, with the background color indicating the average vegetation that was measured by NDVI.

Climate variation drives dengue dynamics



SEM model



PNAS

Climate variation drives dengue dynamics

Lei Xu[a,b,1], Leif C. Stige[b,1], Kung-Sik Chan[c], Jie Zhou[d], Jun Yang[a], Shaowei Sang[a], Ming Wang[e], Zhicong Yang[e], Ziqiang Yan[e], Tong Jiang[f], Liang Lu[a], Yujuan Yue[a], Xiaobo Liu[a], Hualiang Lin[g], Jianguo Xu[a,2], Qiyong Liu[a,h,i,2], and Nils Chr. Stenseth[b,2]

[a]State Key Laboratory of Infectious Disease Prevention and Control, National Institute for Communicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing 102206, People's Republic of China; [b]Centre for Ecological and Evolutionary Synthesis (CEES), Department of Biosciences, University of Oslo, N-0316 Oslo, Norway; [c]Department of Statistics and Actuarial Science, University of Iowa, Iowa City, IA 52242; [d]Institute of Psychology, Chinese Academy of Sciences, Beijing 100101, People's Republic of China; [e]Tropical Diseases Research Base of State Key Laboratory of Infectious Disease Prevention and Control, Guangzhou Center for Disease Control and Prevention, Guangzhou 510440, People's Republic of China; [f]National Climate Center, China Meteorological Administration, Beijing 100081, People's Republic of China; [g]Guangdong Provincial Institute of Public Health, Guangdong Provincial Center for Disease Control and Prevention, Guangzhou 511430, People's Republic of China; [h]Shandong University Climate Change and Health Center, Jinan 250012, People's Republic of China; and [i]World Health Organization Collaborating Centre for Vector Surveillance and Management Beijing 102206, People's Republic of China

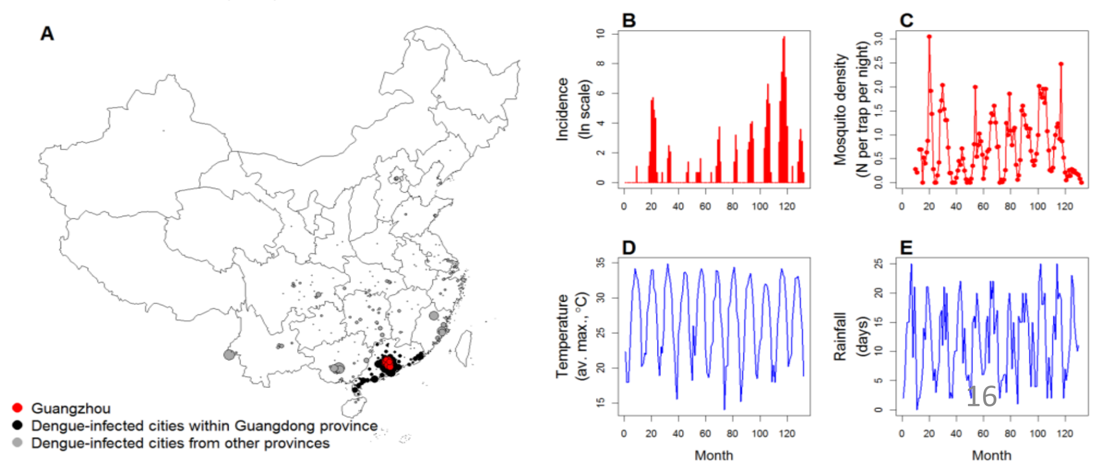
Contributed by Nils C. Stenseth, November 10, 2016 (sent for review September 10, 2016; reviewed by Robert A. Cheke and Kenneth L. Gage)

Climate conditions, through the effects of rainfall and temperature on mosquito abundance and dengue transmission rate, play key roles in explaining the temporal dynamics of dengue incidence in the human population.

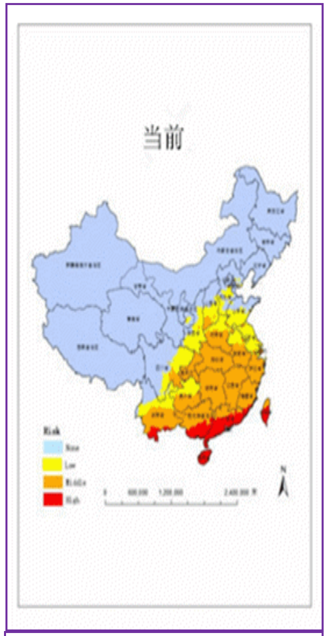
Significance

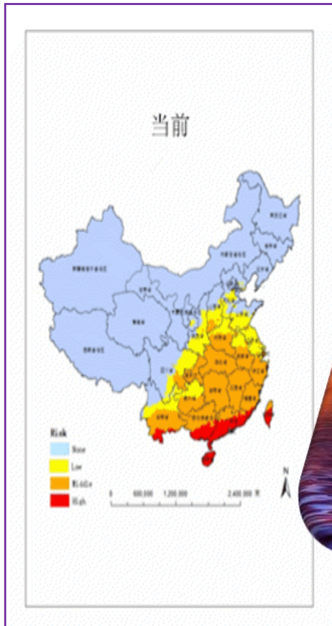
Dengue is a vector-borne infectious disease threatening human health on a global scale. Due to climate change, globalization and other factors, dengue has increasingly spread to new countries and over larger areas, from tropical to temperate zones. In this study, we found that climate has both direct effects on dengue incidence and indirect effects mediated by mosquito density, as mosquitos are the vectors of dengue. The quantitative results derived from this study may be helpful towards advancing our understanding of how climate influences vector-borne diseases, and prove useful for the control and prevention of dengue fever.

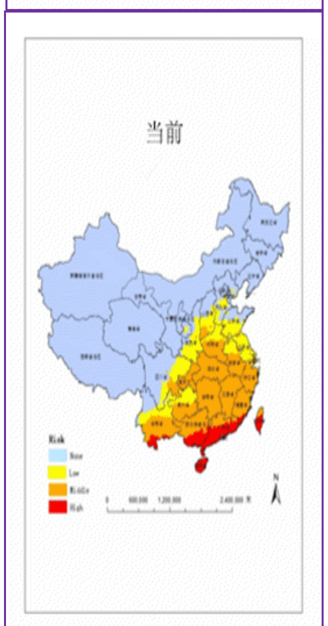
Reserved for Publication Footnotes

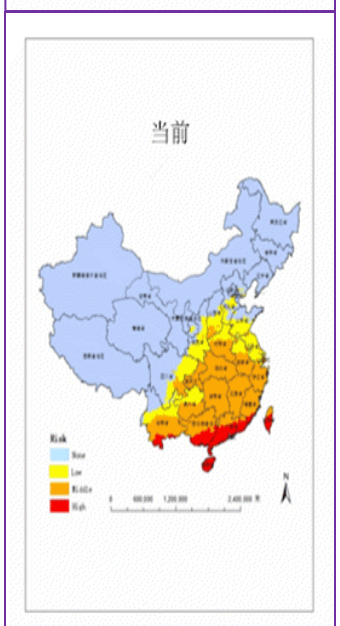


The impact of climate change on dengue fever

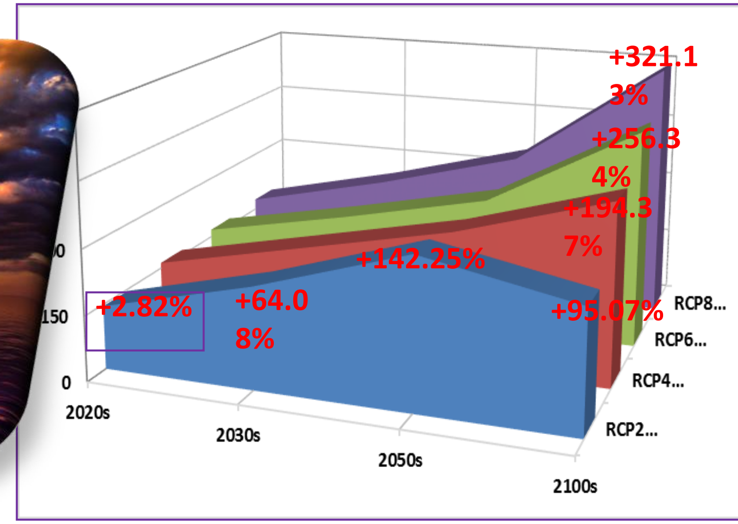








Number of high risk counties or districts : at present, 142

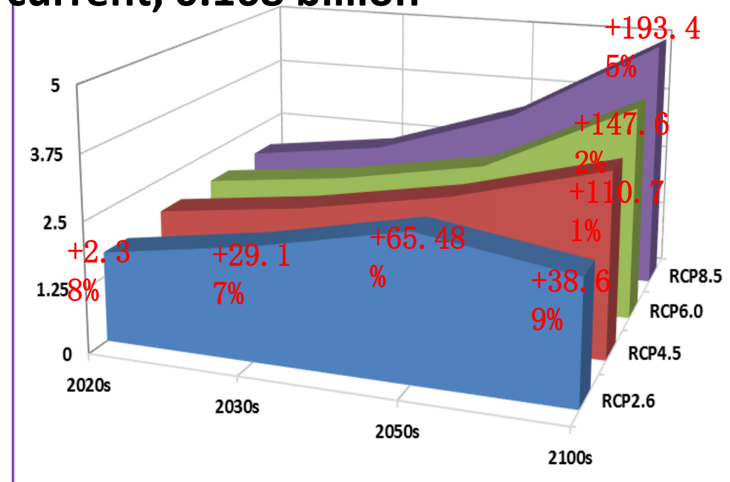


Different RCP scenarios:

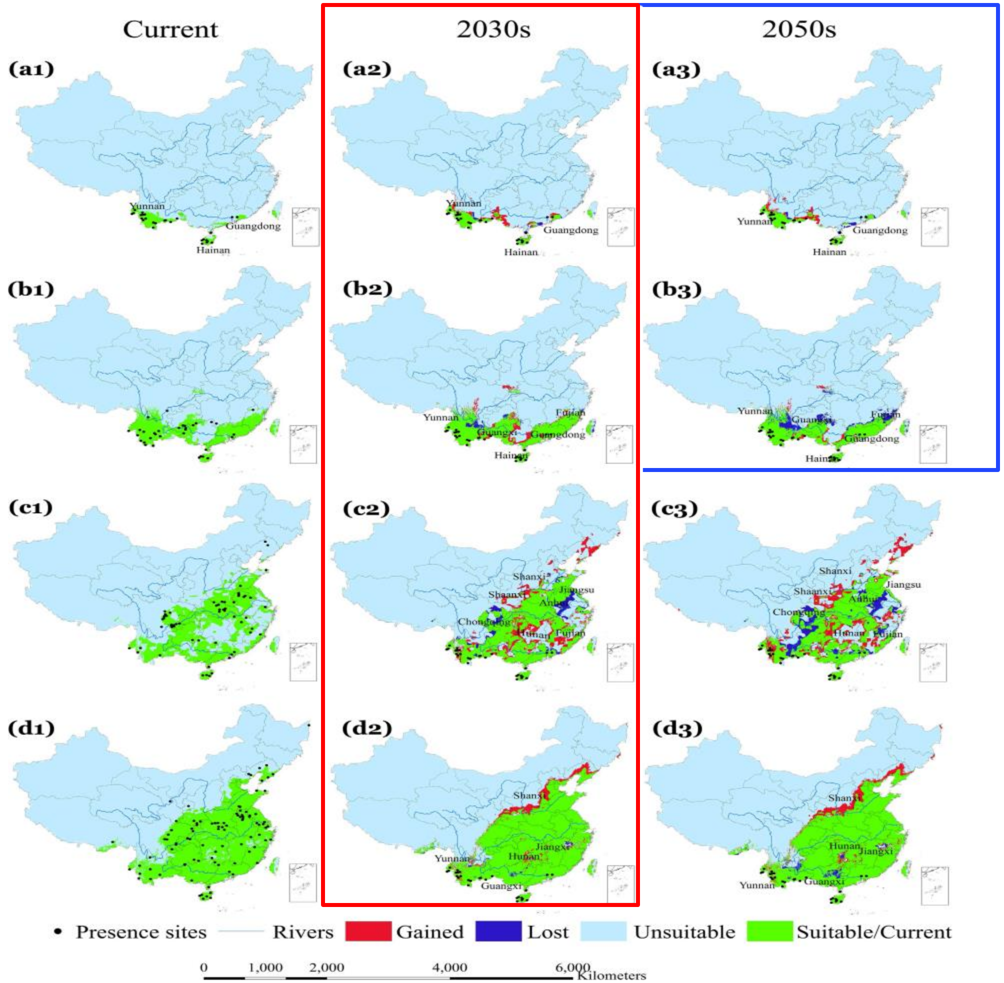
✔**northward extension** of risk area

✔**increase markedly** of risk population

Number of high risk population : current, 0.168 billion



Project the malaria vector distribution under climate change scenarios in China (RCP 2.6)



An. dirus

An. minimus

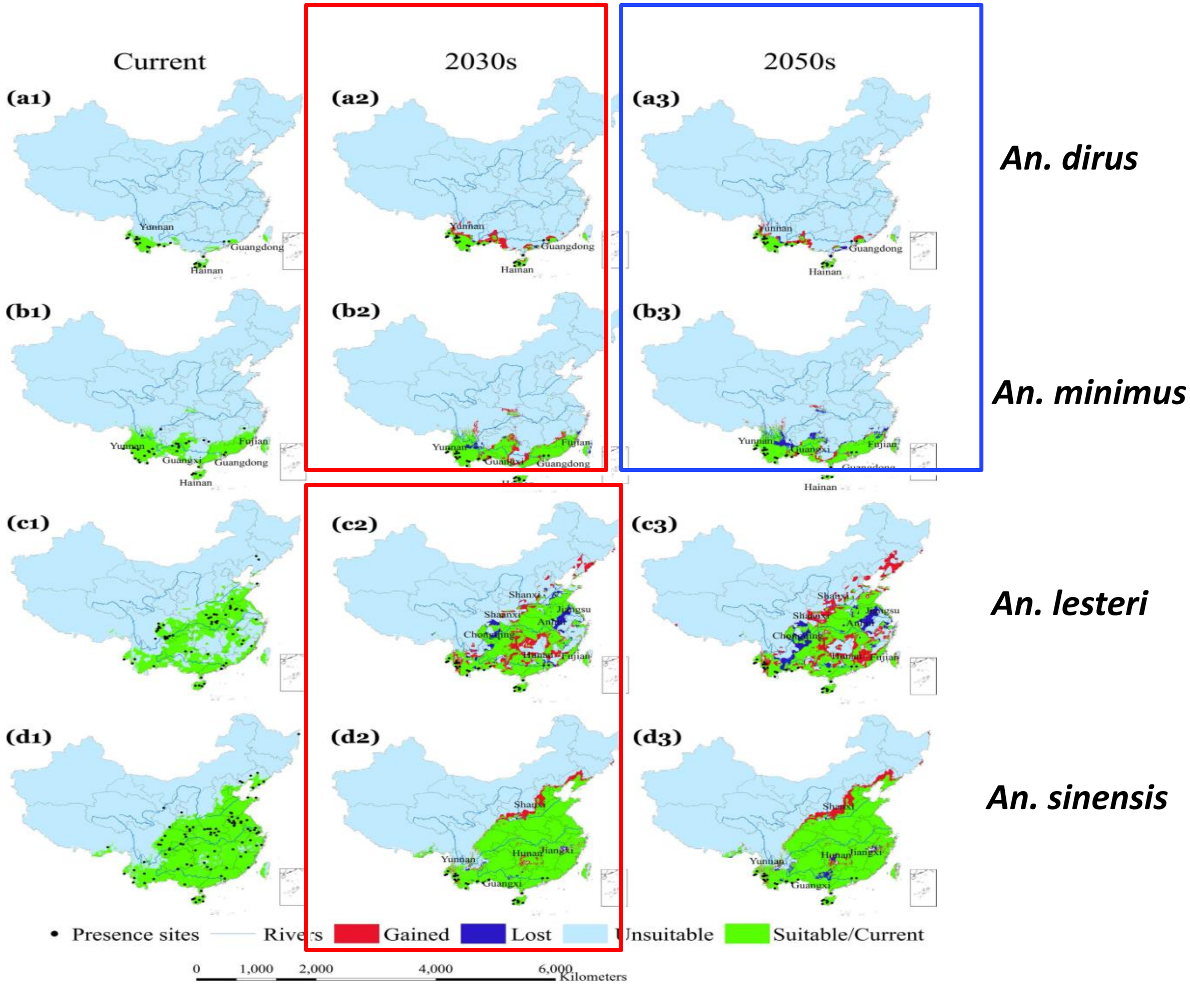
An. lesteri

An. sinensis

Potential current (suitable and unsuitable) and future (suitable/stable, lost, gained, and unsuitable) environmentally suitable area (ESA) for the four dominant vectors under RCP2.6, the lowest greenhouse gas emission scenario.

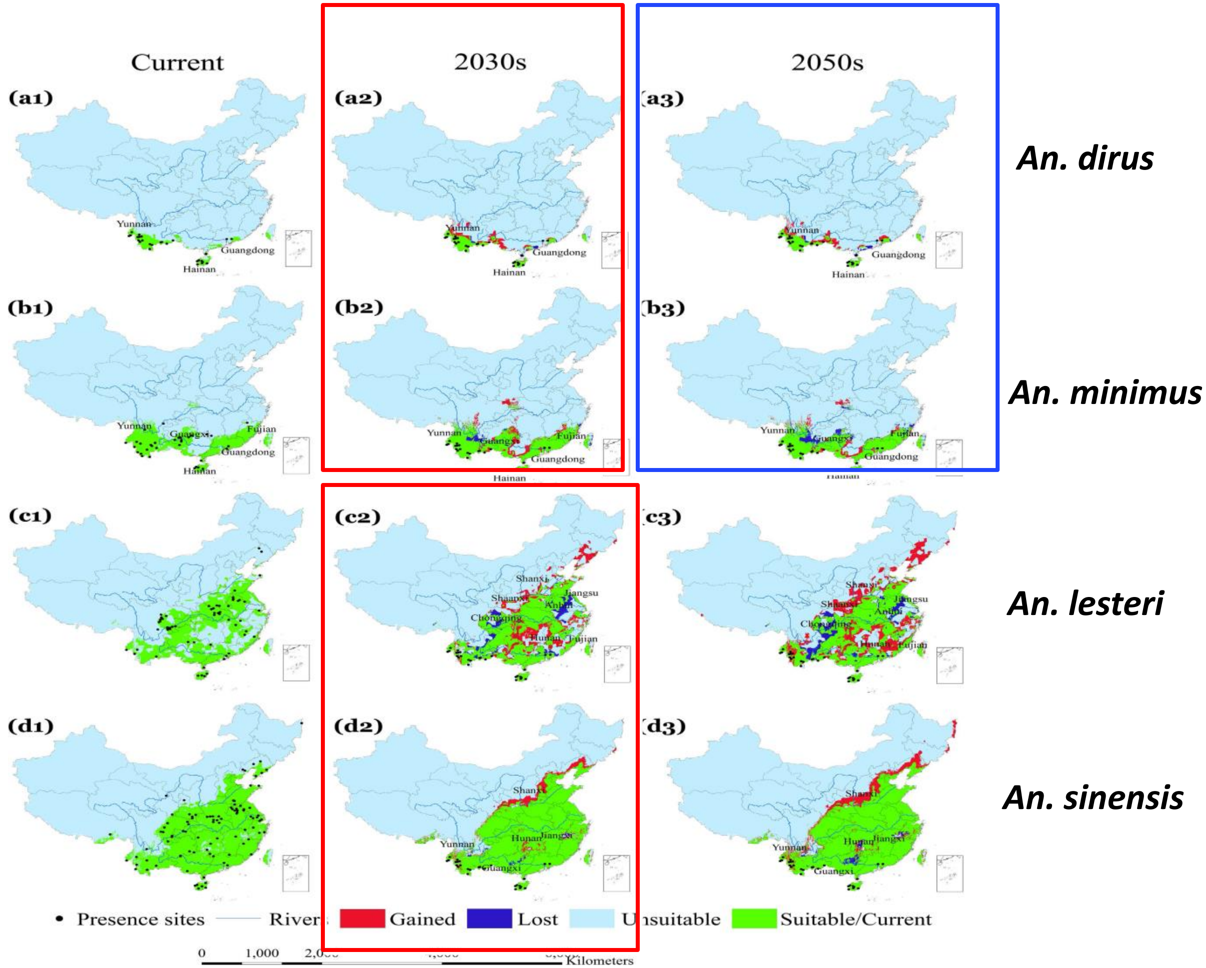
Ren ZP, Wang JF, *scientific reports*, 2015

Project the malaria vector distribution under climate change scenarios in China (RCP 4.5)



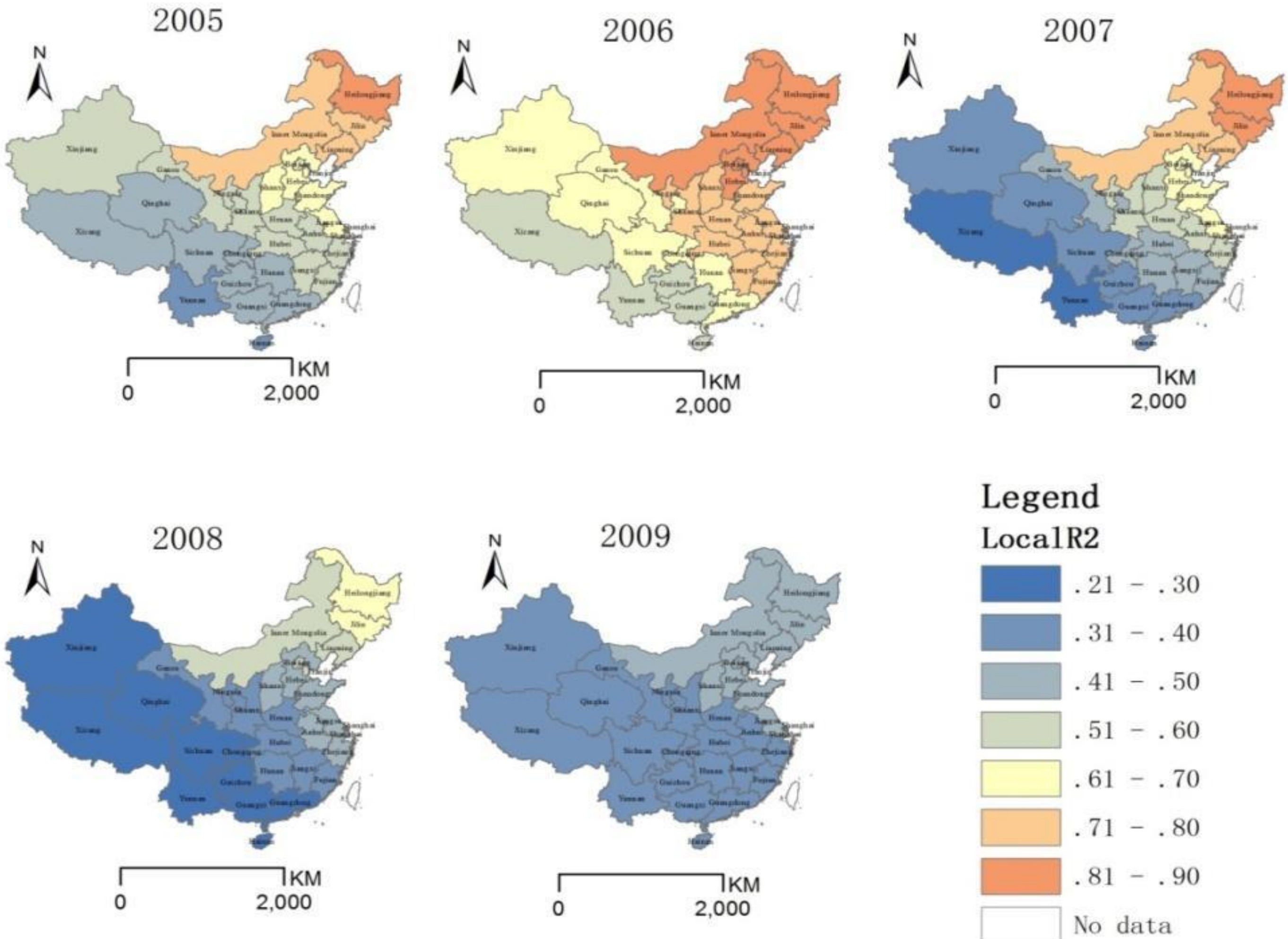
Potential current (suitable and unsuitable) and future (suitable/stable, lost, gained, and unsuitable) environmentally suitable area (ESA) for the four dominant vectors under RCP4.5, the moderate greenhouse gas emission scenario.

Project the malaria vector distribution under climate change scenarios in China (RCP 8.5)



Potential current (suitable and unsuitable) and future (suitable/stable, lost, gained, and unsuitable) environmentally suitable area (ESA) for the four dominant vectors under RCP8.5, the worst greenhouse gas emission scenario.

Heterogeneity analysis of HFRS in China by geographically weightedregression (GWR)



The incidence of HFRS from 2005 to2009 is influenced by temperature, precipitation, relative humidity, January NDVI in the same year, August NDVI in the previous year, and elevation, et al, and heterogeneity in spatical distribution.

Addressing the public health impact of climate change-associated infectious diseases in China

- Title: Building capacity to curb the public health impact of emerging and re-emerging infectious diseases due to climate change in China

- Funding: Australian Government's AusAID Development Research Awards Scheme
  - The Australian Aid program is improving the lives of millions of people in the Asia Pacific region

Peng Bi, 2017

British Embassy
Beijing

China Prosperity Strategic Programme Fund (SPF)

973 CHINA

Perceptive assessment of health risks caused by climate change, air pollution and health co-benefits of low carbon transition in China

Principal investigator: Liu Qiyong

中国疾病预防控制中心
传染病预防控制所
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SKLID
传染病预防控制国家重点实验室
State Key Laboratory for Infectious Disease Prevention and Control

Next steps for biodiversity & human health

- Workshop
- Case study
- Policy
- Action plan
- Actions & activities
- Guidelines


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