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## Prediction of Forest Vegetation using Regional Climate Model in South Korea - Focused on *Pinus densiflora* and *Quercus mongolica* -

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Jae Uk KIM, Dong Kun LEE (Seoul National University, Korea)

# Objectives

To choose a suitable climate model in the South Korea

To verify connection between vegetation communities and environmental factors

To predict potential distribution of *Pinus densiflora* and *Quercus mongolica* 

# **Climate Models**

center	acronym	model	SRES scenario		time period		
National Institute for Environmental Studies (NIES)	NIES/RAMS	NIES/RAMS RCM		A2			1981-1990 2041-2050
Hadley Centre for Climate Prediction and Research	HCCPR	HadCM3		A2		B2	1950-2099
Australia's Common Wealth Scientific and Industrial Research Organization	CSIRO	CSIRO-Mk2	A1	A2	B1	B2	1990-2100
Canadian Center for Climate Modeling and Analysis	CCCma	CGCM2		A2		B2	1900-2100
Center for Climate Research Studies (CCSR) National Institute for Environmental Studies (NIES)	CCSR/NIES	CCSR/NIES AGCM +CCSR OGCM	A1	A2	B1	B2	1890-2100

# **Environmental factors**

category	factors (103)
topography	elevation, aspect, slope
climate	mean temperature (yearly, January, August, Spring, Summer, Fall, Winter), total precipitation (yearly, Spring, Summer, Fall, Winter)
soil	cobblestone of topsoil, gravel of topsoil, soil texture of topsoil, erosion, master color of subsoil, cobblestone of subsoil, soil texture of subsoil, available depth of soil, drainage classes, acidity of soil, organic
etc	radiation, warmth index, coldness index

# Flowchart



# **Current climate (1971~2000)**





### precipitation

temperature

# Future climate (2050)













HADCM3 GCM

CSIRO-Mk2 GCM



CGCM2 GCM



## CCSR/NIES GCM

## **Future climate (2050)**



NIES/RAMS RCM (temperature)



NIES/RAMS RCM (precipitation)

# Future climate (1981~1990)



#### temperature

precipitation

# **Vegetation communities**



## Total: 170 communities

communities	ratio (%)
Pinus densiflora	29.97
Quercus mongolica	26.71
Pd - Qm	5.84
Quercus variabilis	5.58
Pinus thunbergii	4.56

# Pinus densiflora



	ranges	means	
area	29.97 %		
elevation (m)	5~1,542	317.97	
aspect	SE / S / SW		
slope(%)	0~166.4	33.98	
mean temperature (℃)	3.8~14.6	10.68	
total precipitation (mm)	971.7~1,750.7	1,252.09	
warmth index (month·℃)	46.3~118.1	89.36	

# Quercus mongolica



	ranges	means
area	26.71 %	
elevation (m)	64~1,782	647.54
aspect	S / SE / SW	
slope(%)	0~126.2	45.64
mean temperature (℃)	2.0~13.8	7.81
total precipitation (mm)	977.8~1,738.4	1,315.82
warmth index (month·℃)	34.6~111.4	71.57

## **Selected factors**

category	factors (11)
topography	slope*
climate	mean temperature* (January)
soil	none gravelly <sup>*</sup> , very rocky <sup>*</sup> , clay loam <sup>*</sup> , fine loamy/bed rock <sup>*</sup> , acidity of soil <sup>**</sup> , organic <sup>**</sup> , cobblestone of subsoil <sup>*</sup> (<35mm), available depth of soil <sup>*</sup> (>50cm)
etc	radiation*

significant correlations (Chisq <.0001) \*\* significant correlations (Chisq <.05)

# **Simulation I**



## Observed communities



### Simulated communities

# **Simulation II**



## Observed communities



## Potential communities

### Achievements

challenges associated with predicting the future climate using RCM potential distribution of communities to climate change in Korea

### Limitations and Considerations

to examine the potential distribution of communities by correlating the environmental factors without reflecting the natural succession processes

variabilities of multiple RCM output results under various climate change scenarios were not sufficiently considered

ground truth field surveys to enhance the accuracy of the results were not conducted

