Research on carbon sequestration capacity of artificial pasture in Hulunber

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Outline of the Content

1. Background
2. Research objective
3. Overview of the study site
4. Results
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1. Background

- Hulunber has a vast territory, a total area of 253000 km^2,grassland88000km^2.
- The 2012 census results show that **degraded area** of grassland has arrived to **4.83×10^6 ha**, which is account for nearly half of the available area of grassland, and there are nearly **3.00×10^6 ha** of **potential desertification area**.

1. Background

- The **yield** of grassland is **decreasing** year by year;
- **Gramineous** forage has its advantage;

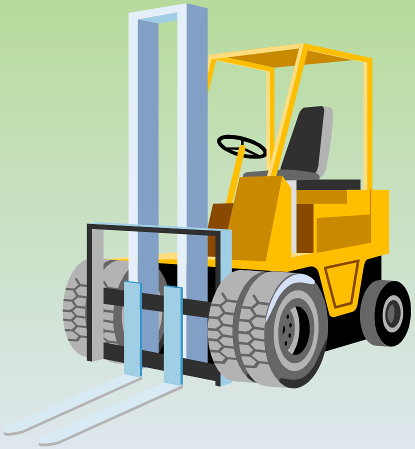
Because of these, artificial pasture obtains the development opportunity.

forage becomes the bottleneck of the development of animal husbandry.

1. Background

The advantages of forage:

- High nutritional value
- High yield, improve the forage yield per unit land
- Man-made interference, affected by climate condition is small

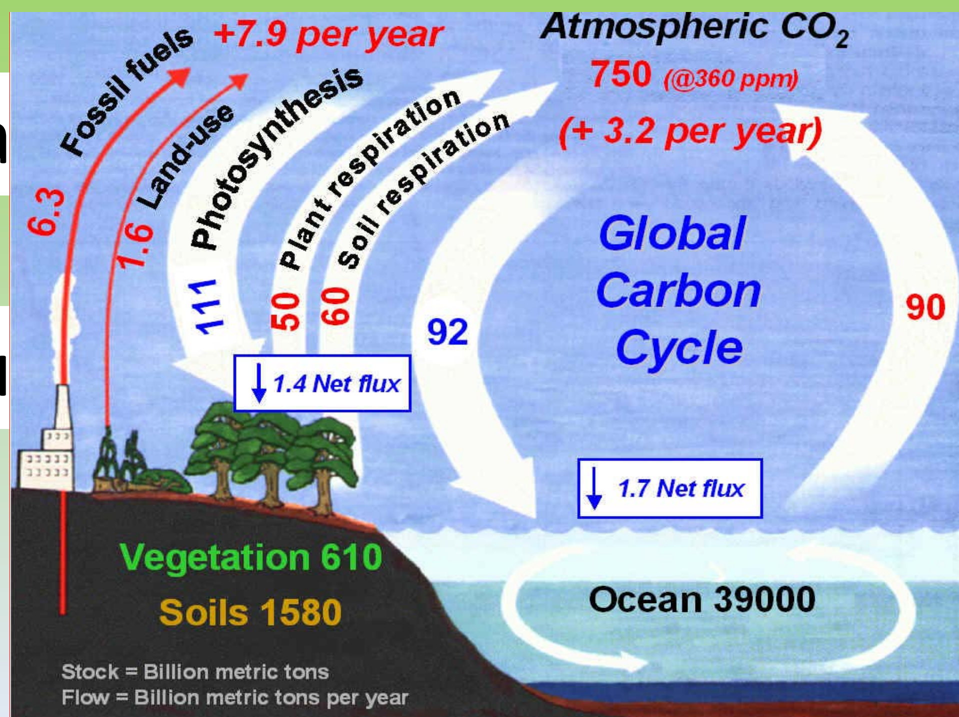


2. Research Objective

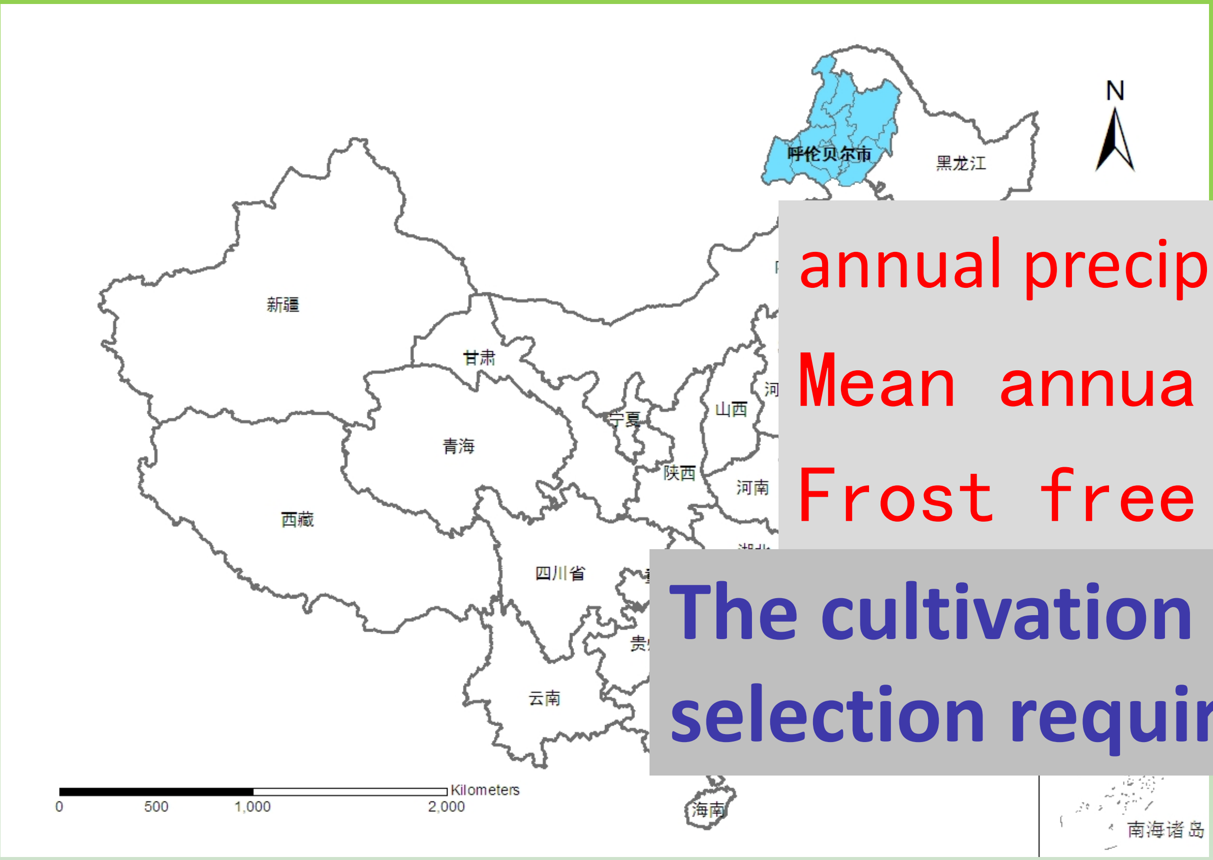
- Herbage caused national attention
- Farmers planting enthusiasm
- The planting area increasing

High fora … ?

How to u … ently?



3. Overview of the study site



annual precipitation:± 350mm

Mean annual temperature:-2℃

Frost free period:110d

The cultivation of forage varieties selection requirements

Site:

alfalfa, seedling(7.5kg/ha),
June2009, seeded,space(40cm)

Experiment design:

Samples: green house gases(GHG) collection,
soil and plant sample

Time: growing season,1 June to 30 September. 3 per day

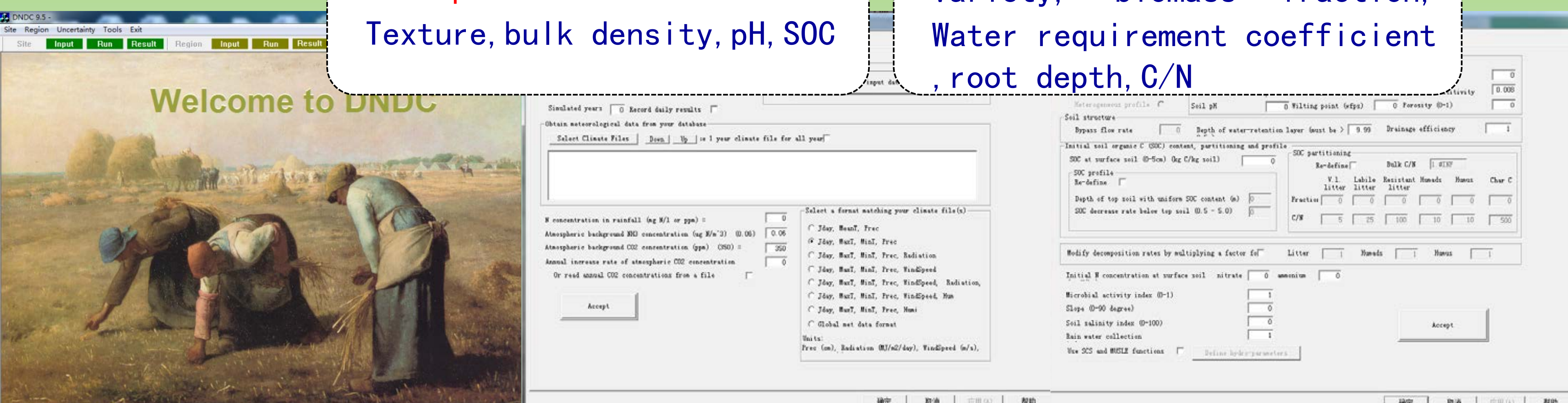
Indexes: CO_2,nitrous oxide(N_2O),
biomass, soil texture, SOC, bulk density

DNDC model

Denitrification (decomposition) model is based on denitrification and decomposition process, which is the most successful N_2O absorption, one of the CO_2 release process mechanism model. The model includes climate, soil and plant function.

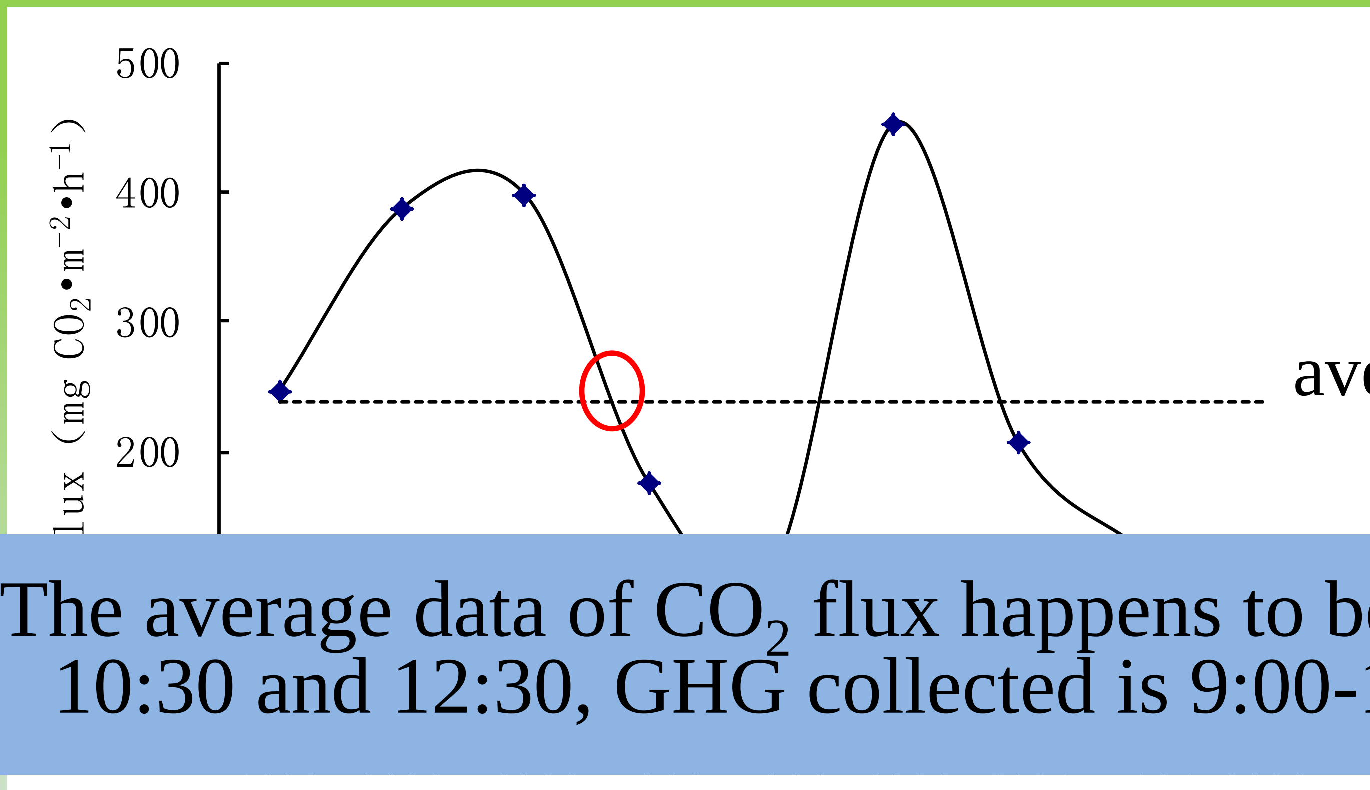
Soil parameter:
Texture, bulk density, pH, SOC

Crop parameter:
Variety, biomass fraction, Water requirement coefficient, root depth, C/N



4. Results

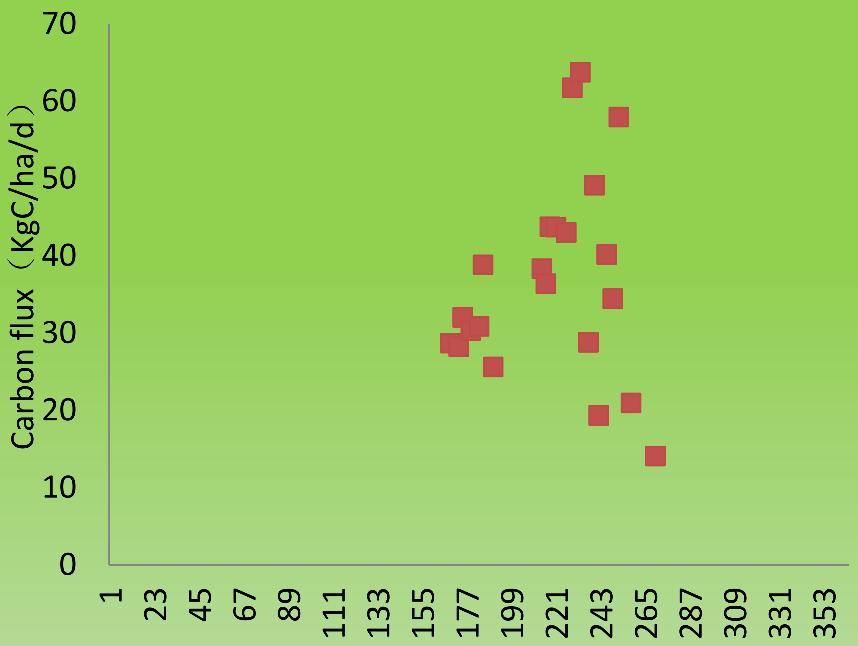
4.1 The dynamic flux of CO_2 emission



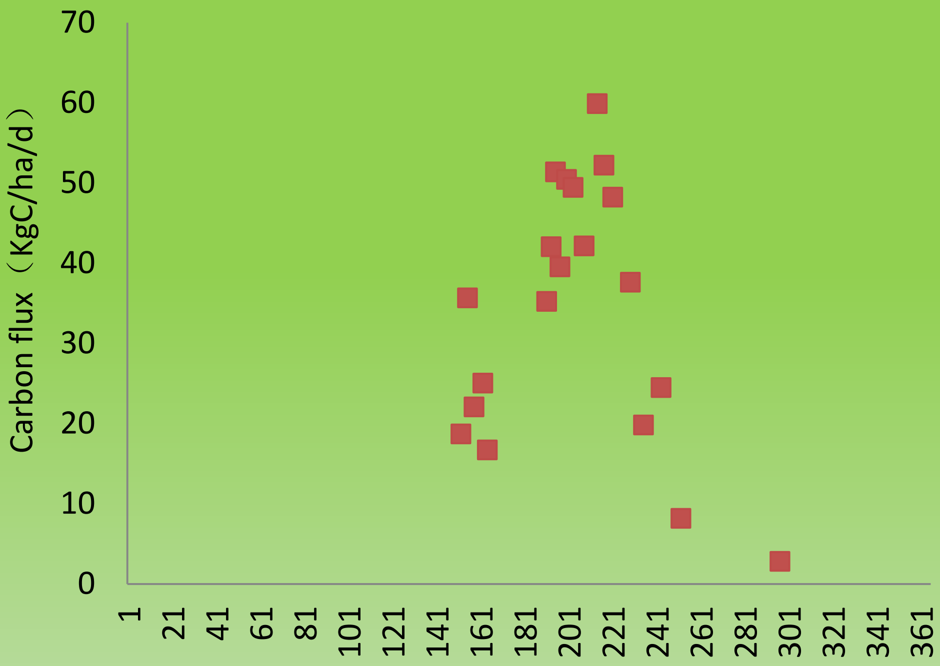
The average data of CO_2 flux happens to between 10:30 and 12:30, GHG collected is 9:00-11:00

The dynamic flux of CO_2 emission in alfalfa cultivated pasture

4.2 The seasonal of CO_2 flux



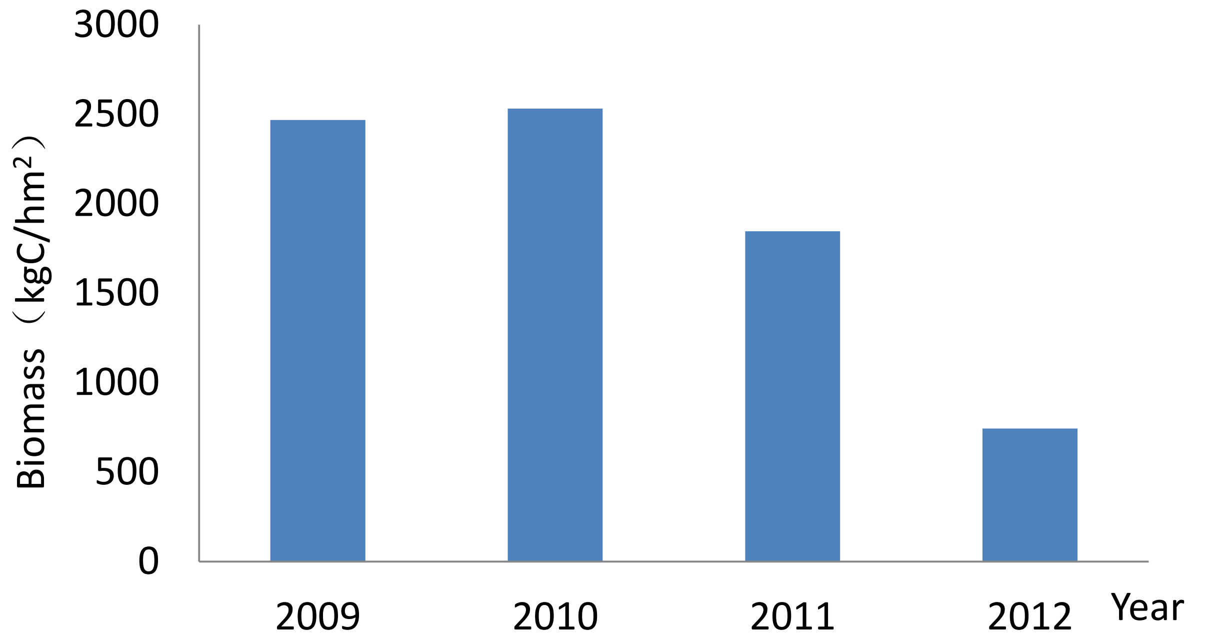
Compared to measured and simulated value of carbon flux in alfalfa pasture(2010)



Compared to measured and simulated value of carbon flux in alfalfa pasture(2011)

CO_2 flux occurred mainly between July and August.

4.3 Change of alfalfa biomass in 2009-2012

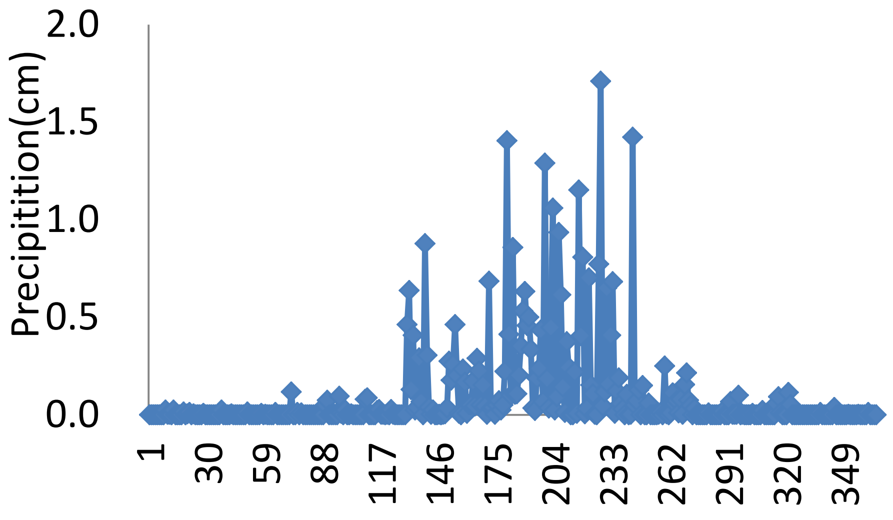


Measured alfalfa biomass in Hulunber grassland in 2009-2012

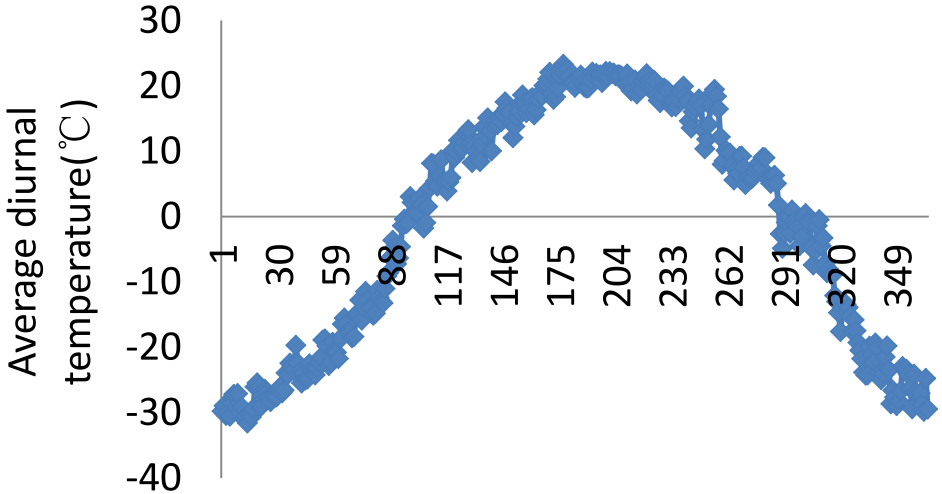
Biomass is influenced by precipitation, especially 2012.

4.4 Impact factors

(1) Climate

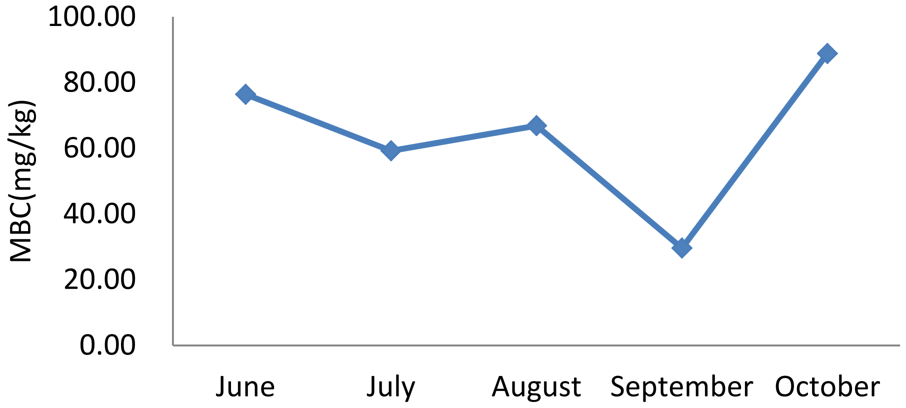


Diurnal change of average precipitation in 2009-2012

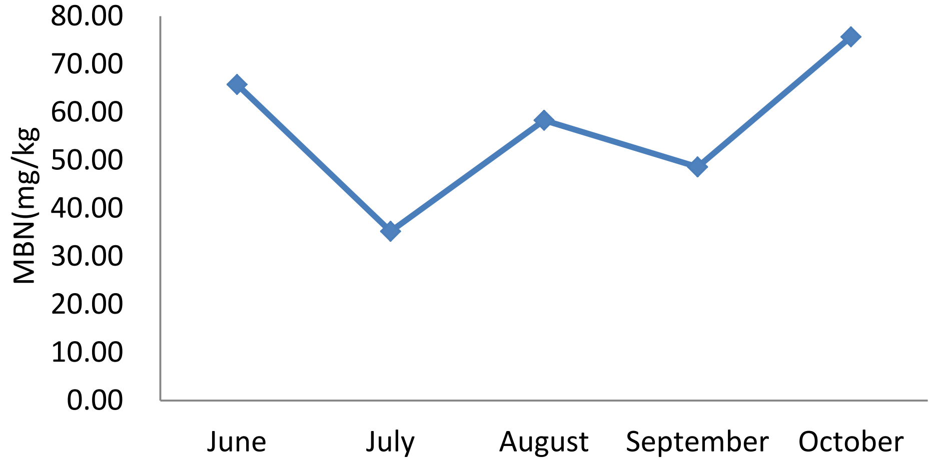


Diurnal change Average diurnal temperature in 2009-2012

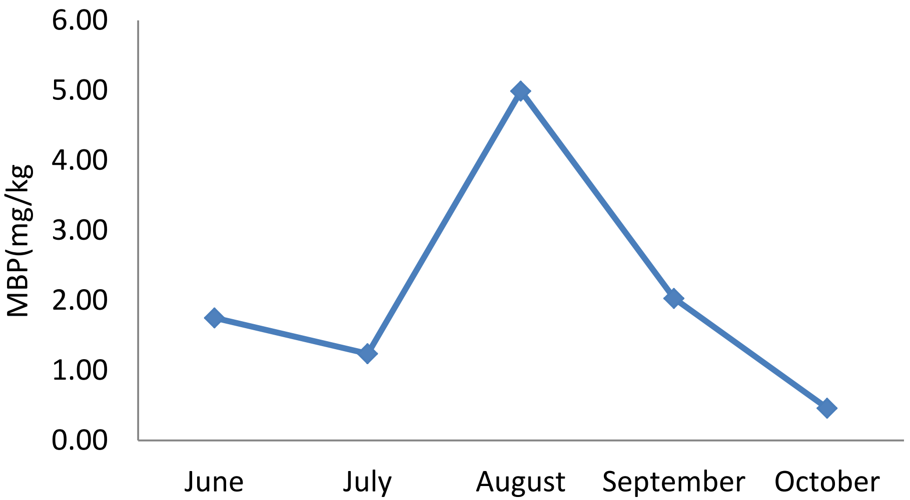
(2) microbial character-microbial biomass



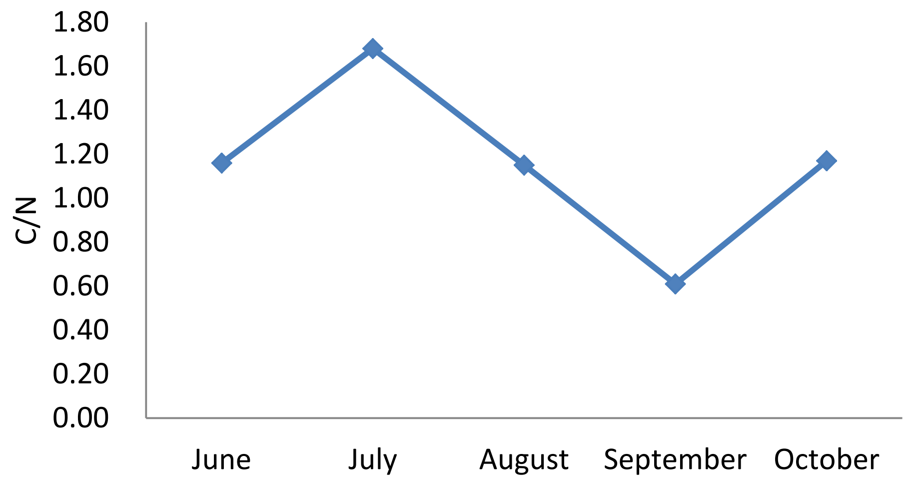
The seasonal change of MBC in 2011-2012



The seasonal change of MBN in 2011-2012

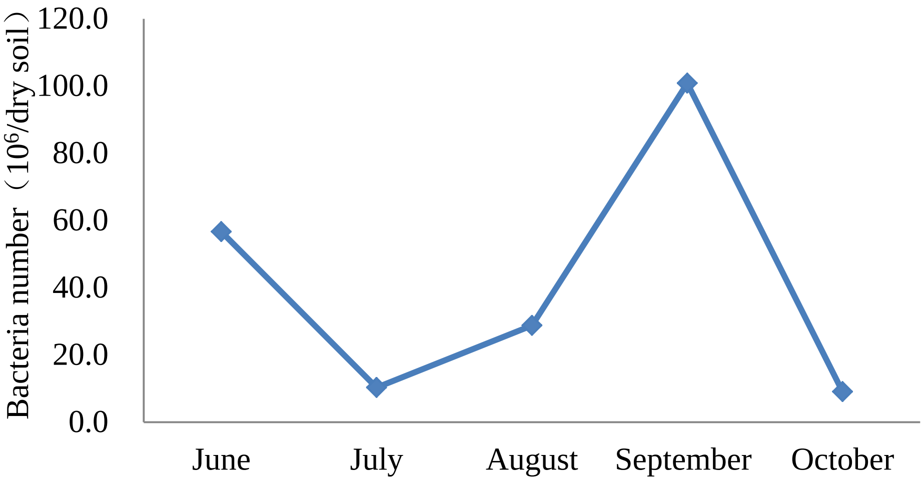


The seasonal change of MBP in 2011-2012

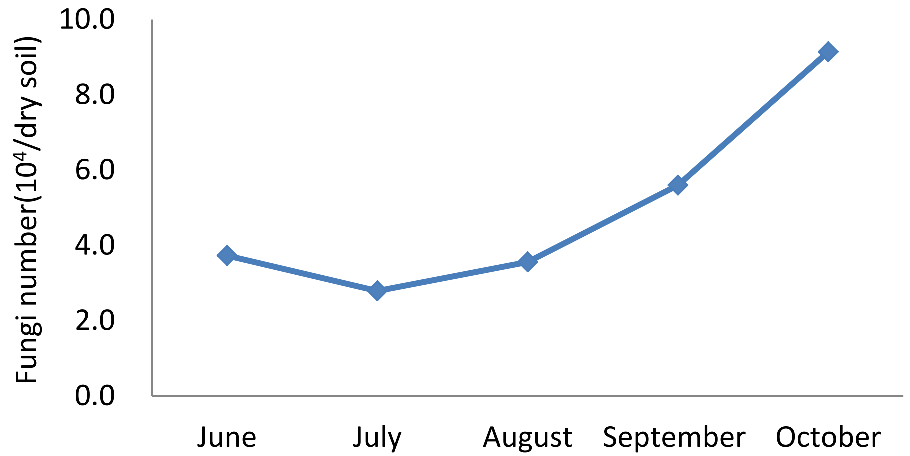


The seasonal change of C/N in 2011-2012

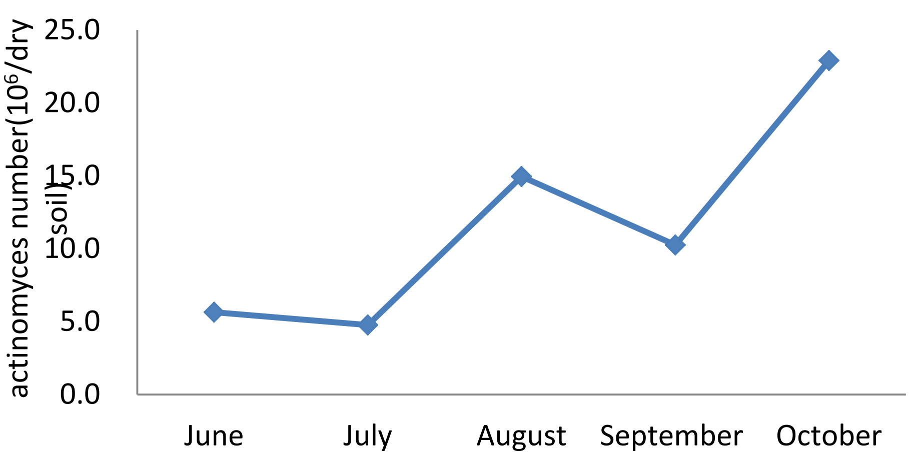
(2) microbial character-microbial amount



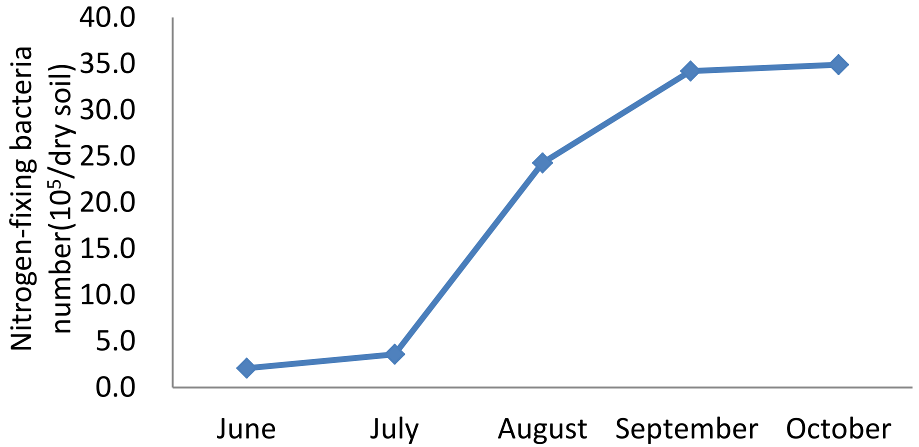
Seasonal change of bacteria number in 2011-2012



Seasonal change of fungi number in 2011-2012



Seasonal change of actinomyces number in 2011-2012

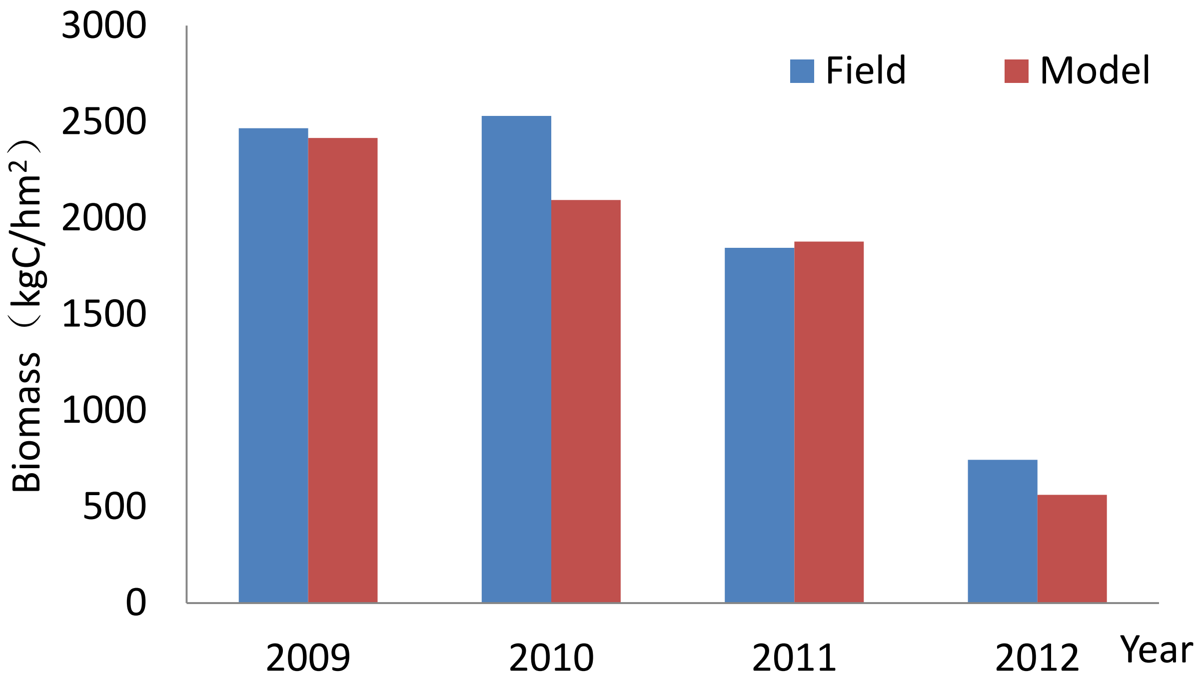


Seasonal change of nitrogen-fixing bacteria number in 2011-2012

(3) Correlation analysis

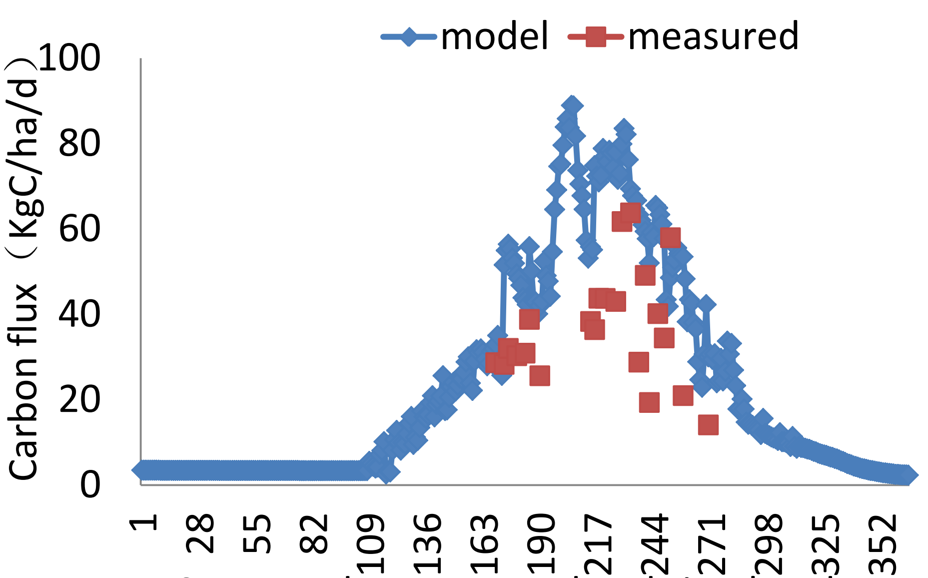
	Index	Correlation	r	P
Carbon flux	**MBC**	y = 3.443x + 53.244	**0.482**	**0.011**
	MBN	y = 5.974x + 51.367	**0.611**	**0.050**
	MBP	y = 4.945x + 37.191	0.191	0.280
	MBC/MBN	y = 18.462x + 31.621	0.573	0.049
	Microbial amount	y = 4.771x + 35.328	**0.785**	**0.003**
	Soil temperature	y = 23.638x + 236.86	0.468	0.325
	Soil water content	y = 24.918x + 101.64	**0.581**	**0.006**
	Precipitation	y = 27.672x + 14.994	**0.560**	**0.030**
	Atmosphere temperature	y = 37.297x - 31.463	0.651	0.117

4.5 Biomass simulation

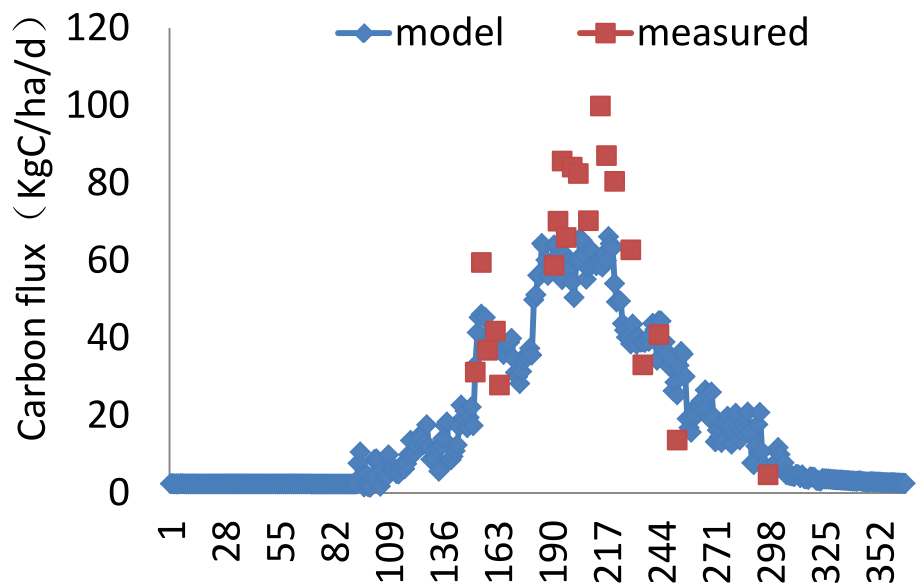


Measured and modeled alfalfa biomass in Hulunber grassland in 2009-2012

4.6 Carbon flux simulation



Compared to measured and simulated value of carbon flux in alfalfa pasture(2010)



Compared to measured and simulated value of carbon flux in alfalfa pasture(2011)

- Growing season of carbon sequestration capacity can present the whole year.
- Microbial biomass & amount, temperature, precipitation, soil moisture ,which have influenced CO_2 flux, is mainly affected by MBC， MBN， microbial amount, soil water content and precipitation.
- Through the model simulation ,the carbon sequestration capacity of alfalfa pasture is nearly 1300 kg C/ha.

4.7 Uncertainty analysis

Biomass frction	2009	2010	2011	2012	P<0.05 level
biomass frction+10%	2746	2356	2144	652	A
biomass frction-10%	2160	1870	1684	502	C
CK	2452	2108	1914	582	B

Water requirement coefficient	2009	2010	2011	2012	P<0.05 level
Water requirement coefficient+10%	2424	2068	1864	560	E
Water requirement coefficient+5%	2438	2088	1888	570	D
Water requirement coefficient -10%	2486	2166	1976	615	A
Water requirement coefficient-5%	2468	2128	1942	594	B
CK	2452	2108	1914	582	C

C/N	2009	2010	2011	2012	P<0.05 level
C/N+10%	2452	2110	1916	584	A
C/N-10%	2452	2120	1912	582	AB
C/N-15%	2452	2102	1908	578	B
C/N+15%	2452	2128	1916	584	AB
CK	2452	2108	1914	582	AB

SOC	2009	2010	2011	2012	P<0.05 level
SOC+20%	1440	2016	1798	538	B
SOC+10%	1440	2070	1814	556	B
SOC-20%	1476	2038	1876	562	B
SOC-10%	1508	1914	1868	491	B
CK	2452	2108	1914	582	A

Texture	2009	2010	2011	2012	P<0.05 level
sand	2610	2494	2174	568	A
loam	2272	2188	1956	675	A
loamy sand	2622	2136	1888	542	A
CK	2452	2108	1914	582	A

Irrigation	2009	2010	2011	2012	P<0.05 level
50mm	2582	2086	1886	570	A
75mm	2582	2102	1884	570	A
100mm	2586	2092	1884	572	A
200mm	2592	2084	1884	572	A
CK	2452	2108	1914	582	A

Fertilizer	2009	2010	2011	2012	P<0.05 level
Fer+10%	2418	2076	1886	572	A
Fer+5%	2418	2076	1886	572	A
Fer-10%	2418	2076	1886	572	A
Fer-5%	2418	2076	1886	572	A
CK	2418	2076	1886	572	A

Analyzed the different indexes, which affect the carbon

Crop parameter mainly affect the carbon sequestration capacity of alfalfa artificial pasture in Hulunber.

difference between biomass fraction, C/N, demand water, SOC and carbon sequestration capacity (P<0.05),others not.

5. Further work

- The accuracy of DNDC model
- Effect on simulation of cutting to the productivity
- Simulation of the regrowth of perennial forage


Welcome to China ,
welcom to Hulunber
Thank for your attention