



慈濟醫療志業

Tzu Chi Medicine Mission



# Plant-based diets in hospitals to reduce green house gases (GHG) production

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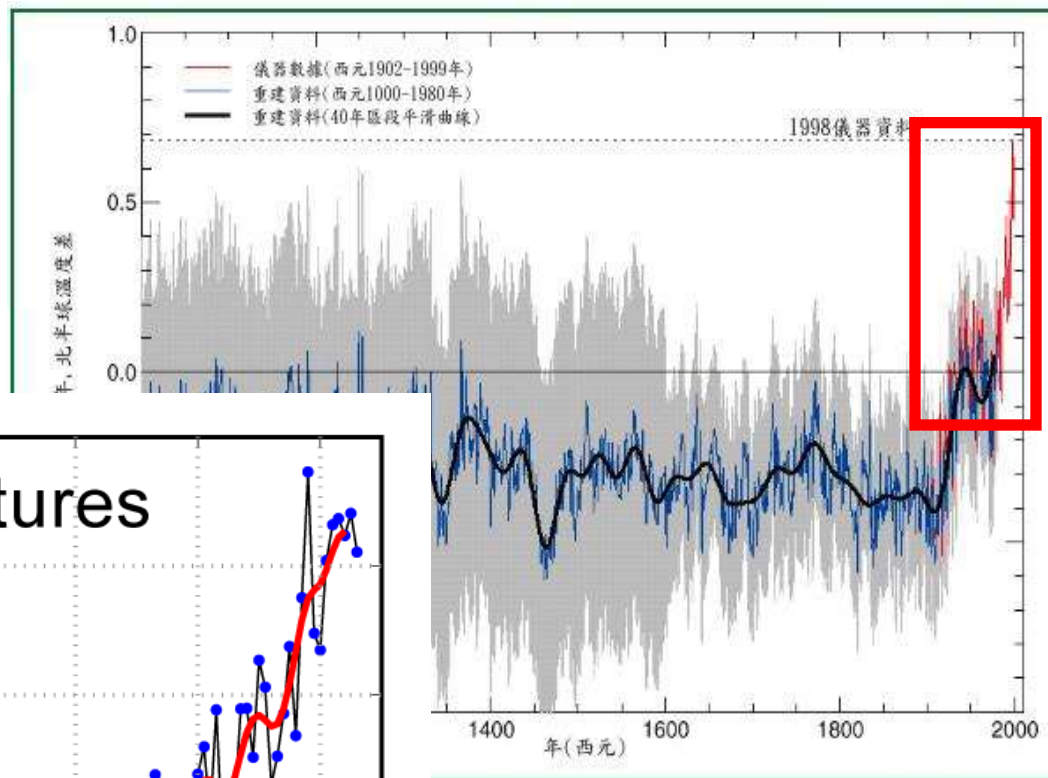
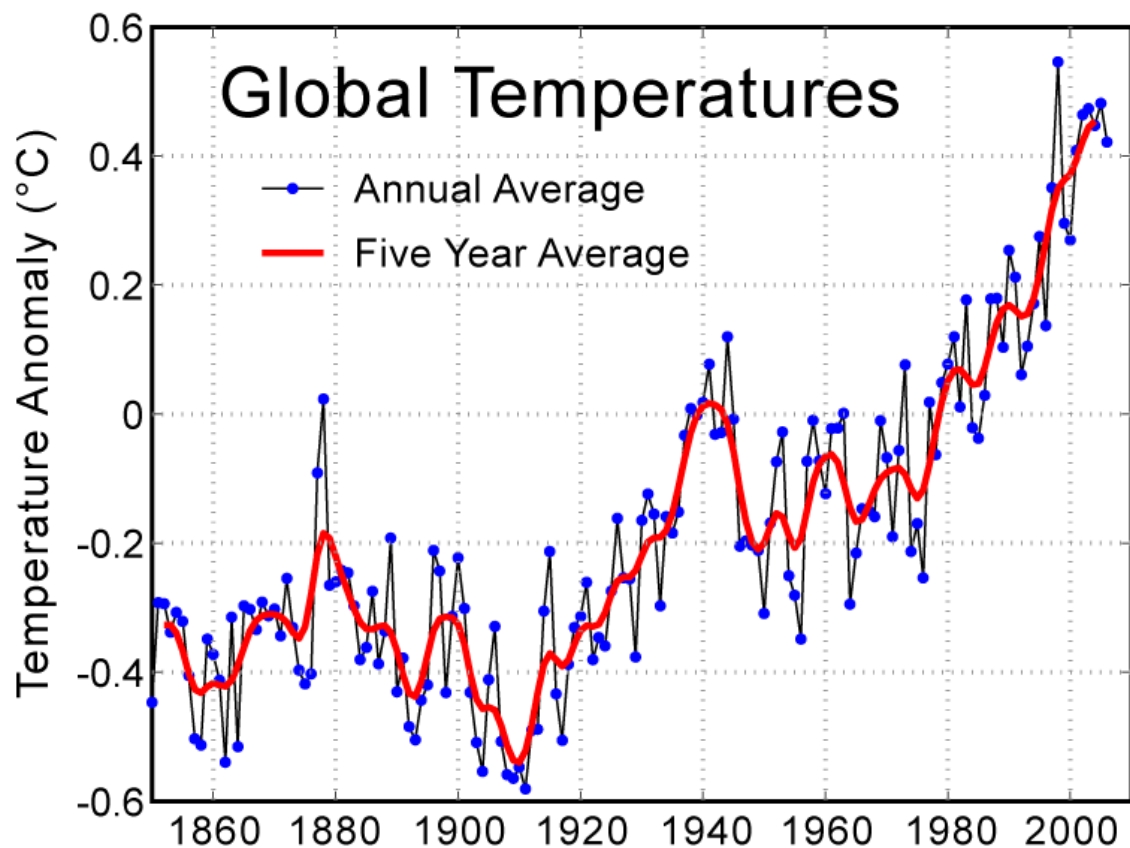


尊重生命 人本醫療

# Outline

- 1. Global warming and green house gases (GHGs)**
- 2. Livestock's impact on climate change**
- 3. Tzu Chi's successful Vegetarian Programs in Hospitals**





# Extreme Weather Changes

敬天愛地 敬揚德  
Respect Heaven and Love the Earth  
To Accumulate Blessings

與地球共生息  
Coexist with Earth

## Global warming, Greenhouse effect

### Global Warming

聖嬰現象造成歐洲遭到  
熱浪侵襲和颶風等不正  
常的氣候。

尼泊爾因喜馬拉雅山積  
層雪而變成龐亞水災。  
沙漠化嚴重且缺水，因  
全球暖化而乾旱加劇。

過熱的氣候加強水  
分的蒸發，非洲境  
內沙漠化地區逐年  
增加，旱災頻傳。

排水量巨大的印尼雅  
加達近年嚴重水災。

內蒙古沙漠化造成大  
陸華北、東亞國家沙  
塵暴。  
大陸甘肅嚴重缺水，  
造成土地貧瘠。  
非洲西南的豪大雨促  
成嚴重洪氾區災。

「桑迪、佛羅、羅伊斯  
等颶風，屢次襲擊  
東亞地區。

沙漠地帶占百分之七  
十的澳洲連年乾旱造  
成穀物和畜產減量。

美國中西部在2004年5  
月底遭受一百多級捲  
風橫掃。

2005年夏天，數百個美  
國城市都締造史上最  
高溫的紀錄。

現今地球就像是火宅，人類  
破壞生態環境，使得地球溫  
度升高，「溫室效應」導致  
冰山融化、海水漲高，甚至  
四季的天候紊亂，萬物失去  
正常生長的規則。——陸農上人

Today's Earth is like a house on fire. The damage  
mankind does to the planet has caused global  
temperatures to rise, disrupting the harmonious order  
of the four seasons and hindering the natural growth  
of all things on Earth.——Master Cheng Yen

格陵蘭冰層因氣候暖化逐年  
溶解。北極冰層預計於30年  
內完全溶解消失。

2005年9月初卡崔颶風狂掃  
美國南部墨西哥灣沿岸。

玻利維亞、委內瑞拉、阿根廷  
異常暴用帶來土石流。

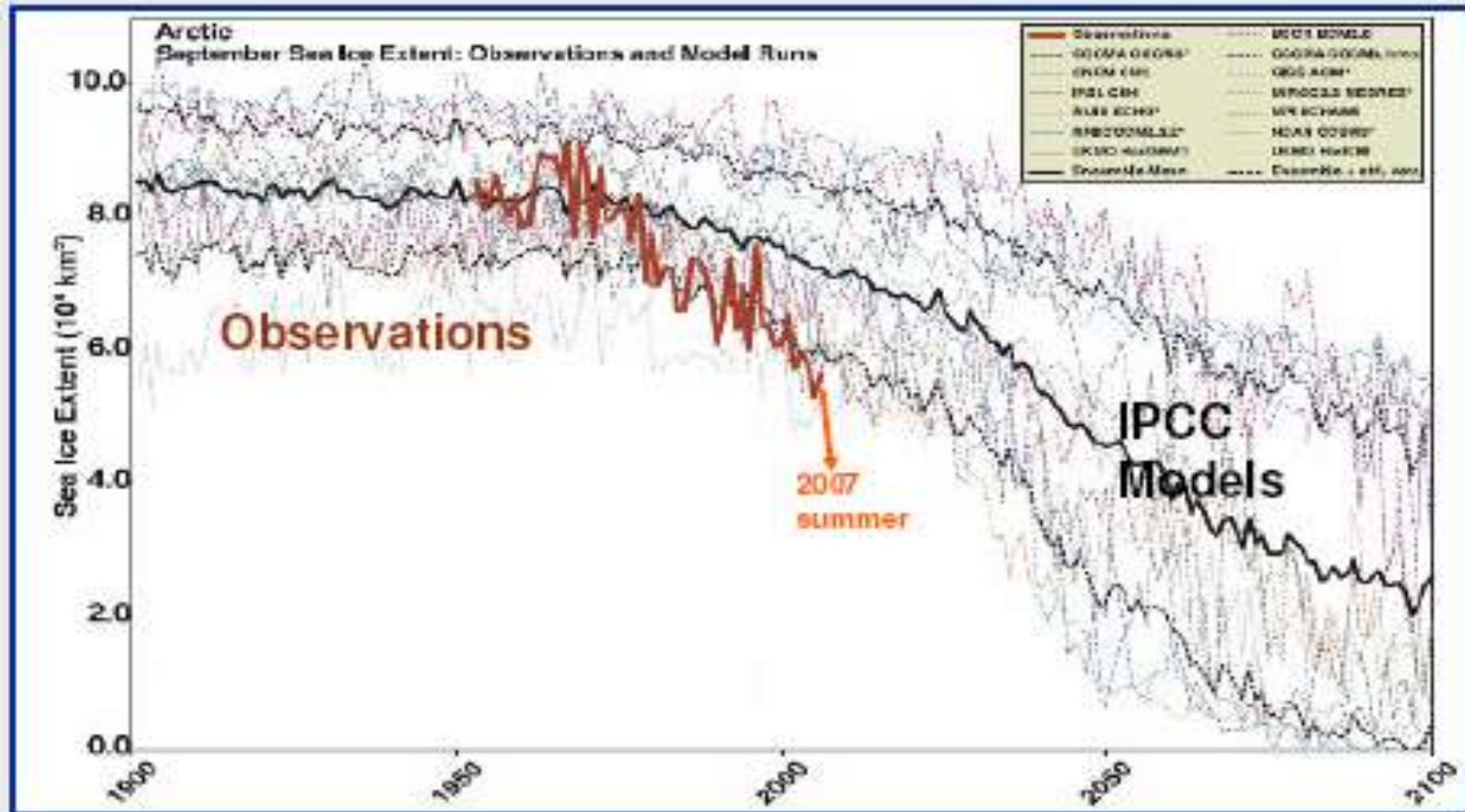
紐西和智利連  
續發生強震。



Arctic sea ice decline: Faster than forecast, *GRL* May 2007.

J. Stroeve, M. Holland, W. Meier, T. Scambos, and M. Serreze, U. Colorado and NCAR

## Ice Areal Extent at Sept. Min.

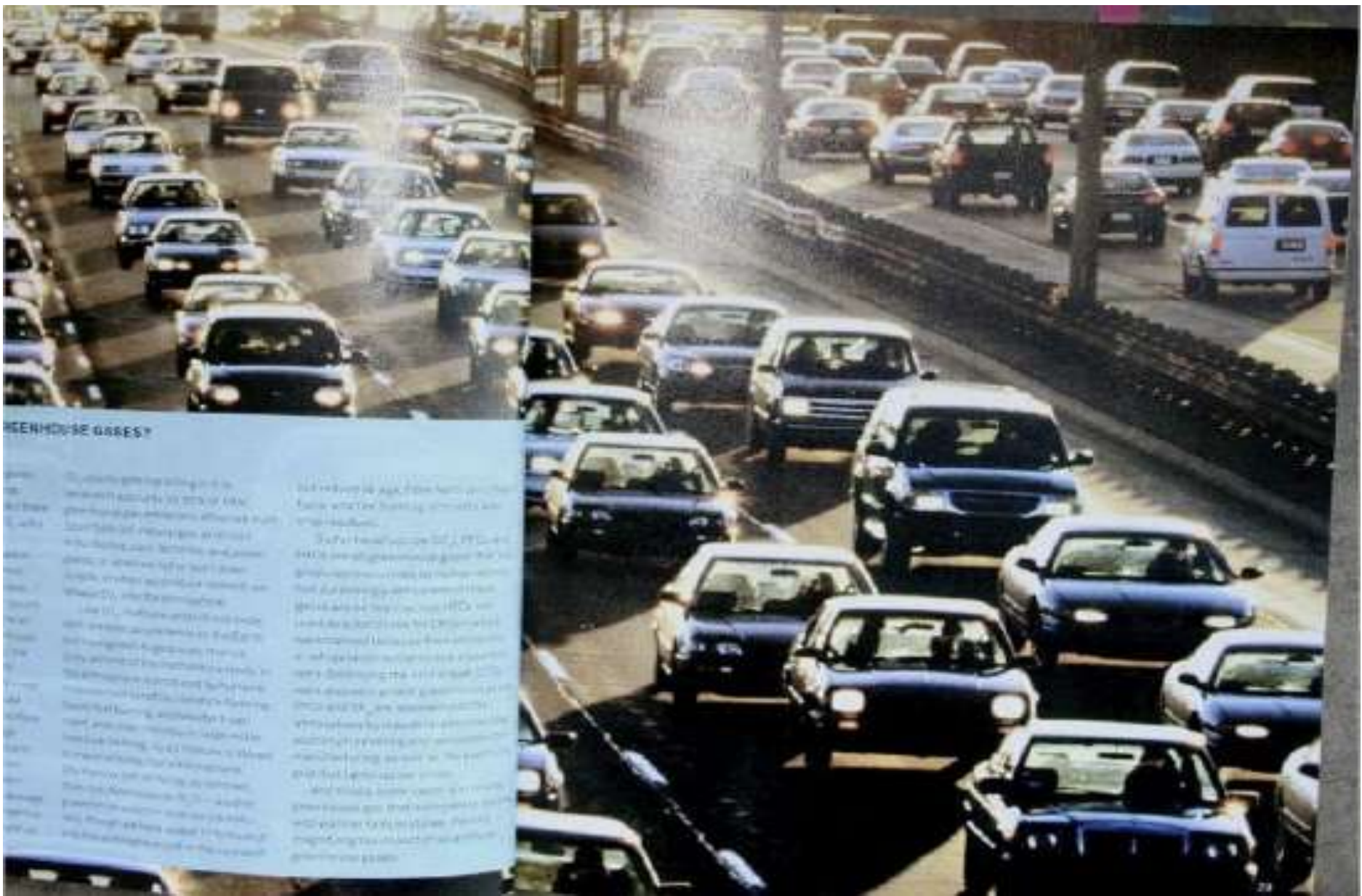






Accumulation  
of hot gases





GREENHOUSE GASES?

It is a common misconception that the greenhouse effect is a simple process of heat being trapped by the atmosphere. In reality, it is a complex process involving the absorption and re-emission of infrared radiation by greenhouse gases. This process is essential for maintaining the Earth's temperature, but an excess of these gases can lead to global warming.

The greenhouse effect is a natural process that warms the Earth's surface. When the Sun's rays hit the Earth, some of the energy is absorbed by the ground and water. This energy is then re-emitted as infrared radiation, which is trapped by greenhouse gases in the atmosphere. This process is essential for life on Earth, as it keeps the planet warm enough for us to live on.

However, human activities have increased the amount of greenhouse gases in the atmosphere, leading to global warming. This is caused by the burning of fossil fuels, deforestation, and other activities that release large amounts of carbon dioxide and other greenhouse gases. The result is a rise in the Earth's average temperature, which is causing a range of problems, including melting glaciers, rising sea levels, and more frequent extreme weather events.



# Livestock's impact on climate change

# Livestock's long shadow

FAO (2006):

Livestock contributing to

- 18% GHG emission
- Land degradation
- Air pollution
- Water pollution
- Reduction in biodiversity

livestock's long shadow  
environmental issues and options



# World Watch Institute

## 2009/Nov/Dec Issue



### Uncounted, Overlooked, and Misallocated Livestock-related GHG Emissions

	Annual GHG emissions (CO <sub>2</sub> e) million tons	Percentage of worldwide total
FAO estimate	7,516	11.8
<b>Uncounted in current GHG inventories:</b>		
1. Overlooked respiration by livestock	8,769	13.7
2. Overlooked land use	≥2,672	≥4.2
3. Undercounted methane	5,047	7.9
4. Other four categories (see text)	≥5,560	≥8.7
Subtotal	≥22,048	≥34.5
<b>Misallocated in current GHG inventories:</b>		
5. Three categories (see text)	≥3,000	≥4.7
<b>Total GHGs attributable to livestock products</b>	≥32,564	≥51.0



# GHG emission in food and agriculture sector

- 80% of GHG emission in agriculture sector come from livestock

Solutions to mitigate climate change should focus on livestock

Friel et al.Lancet, 2009



# Committee on Climate Change's recommendations

- Aim:
- 2030: ↓50% GHG emission (compared with 1990)
- 2050: ↓80% GHG emission (compared with 1990)



# Climate mitigation solutions in Food and Agriculture sector

- Greater efficiency in livestock farming
- More carbon capture through land use
- Better manure management
- Less dependence on fossil fuels
- All the above technology →

**Not Enough to Achieve the 2030 Goal**

**↓30% livestock is needed in addition**



# Side Effect of 30% ↓ in livestock?

- ↓ saturated fat from meat and dairy  
↓ **heart disease** by 15% in UK and by 16% in city of Sao Paulo, Brazil
- Other :  
↓ **obesity, diabetes, hypertension, some forms of cancer**

Friel et al. Lancet, 2009



# ADA's position on vegetarian diet

- Appropriately planned vegetarian diets, including total vegetarian or vegan diets, are **healthful**, **nutritionally adequate**, and may provide health benefits in the **prevention and treatment of certain diseases**.
- Well-planned vegetarian diets are appropriate for individuals during all stages of the life cycle, including **pregnancy**, **lactation**, **infancy**, **childhood**, and **adolescence**, and **for athletes**.

American Dietetic Association (ADA), 2009



# Tzu Chi General Hospital's Vegetarian Program



# Vegetarian meals for patients

- No fish, meat, poultry or any animal flesh served in Tzu Chi Hospitals
- Lacto-ovo vegetarian meals, vegan options available
- Reach Taiwan's DRIs through plant based diets
- Fresh and local produces
- Minimizing processed and canned foods



# Vegetarian meals for patients

- Include grains, vegetables, fruits, soy and beans, seeds and nuts, eggs, plant oils; dairy used occasionally.
- Options of grain choices: white rice, brown rice, multi-grain rice, noodles, congee, steamed buns (“Munto”)



Soy bean curd with red and yellow pepper in tomato sauce

Stir-fry spinach

Tofu wrapped in veggie ham

Stir-fry bok choy and carrots



Rice with black sesame

Tofu and bean sprout soup

Fresh melon

Stir fry egg plants

Asparagus with baby corn and sweet pepper

Broccoli and carrots with black mushrooms

Laver (seaweed) soup with gogi berries



Tofu wrapped in veggie ham

Noodles

Fresh fruit plate





# Cashew mushroom soup with gogi berries in Chinese herbal broth



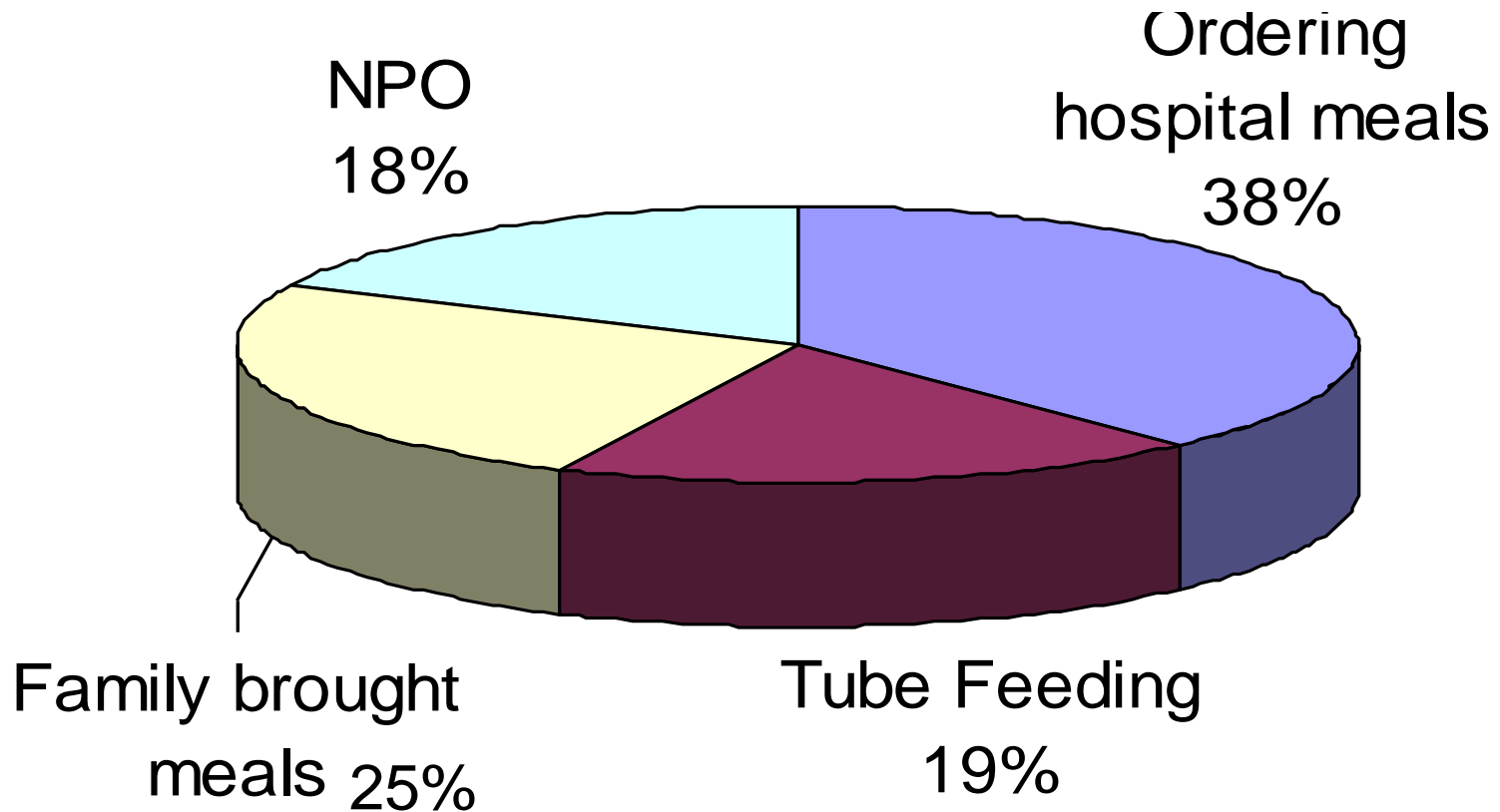
# Peanut – Azuki bean – Tapioca Dessert



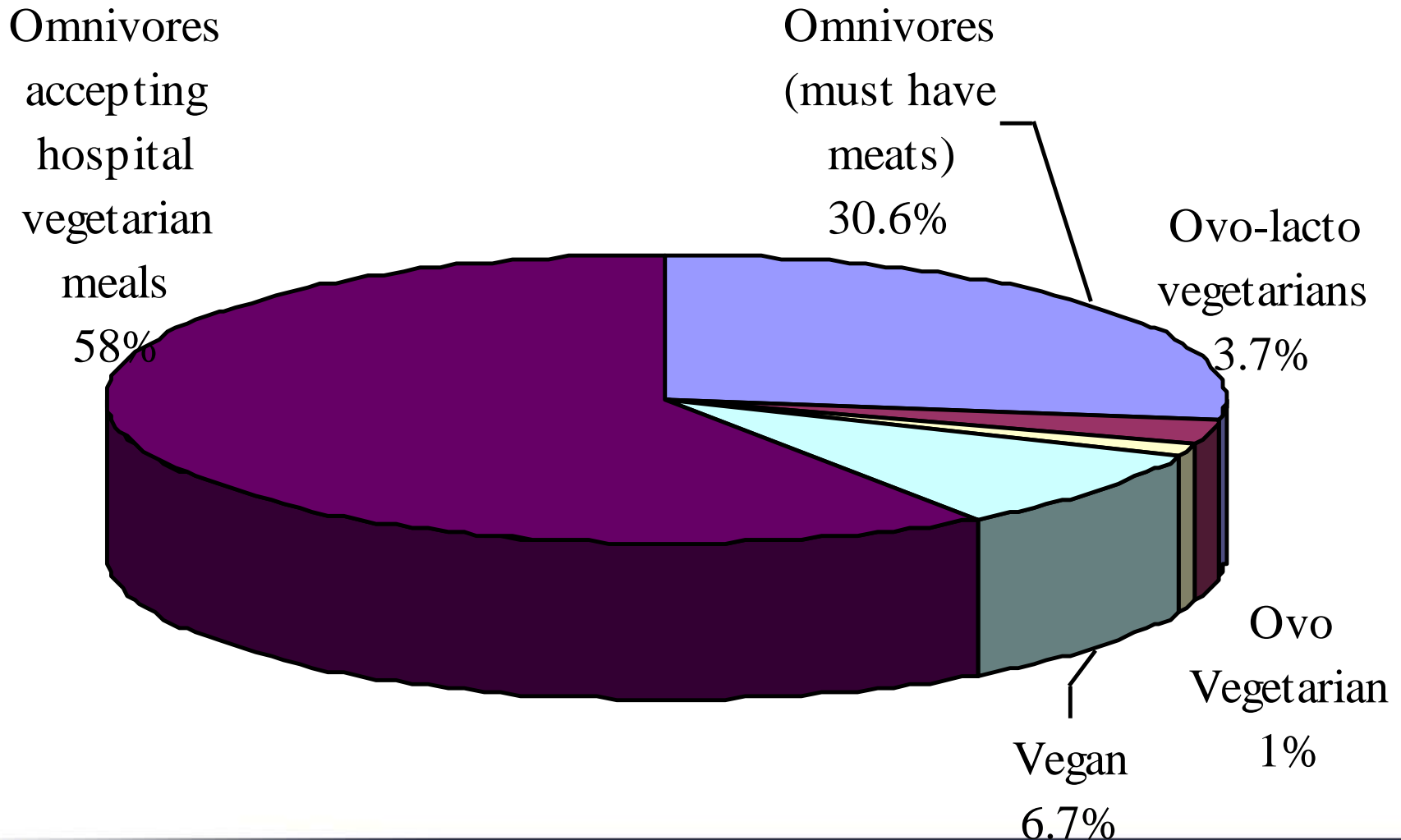
# Peanut and dessert tofu Soup



# Patients' diet in Tzu Chi General Hospital, Taipei Branch



# Patients' dietary habits (Tzu Chi Hospital, Taipei Branch)



# Vegetarian Food Court for out patients, families, visitors and staffs

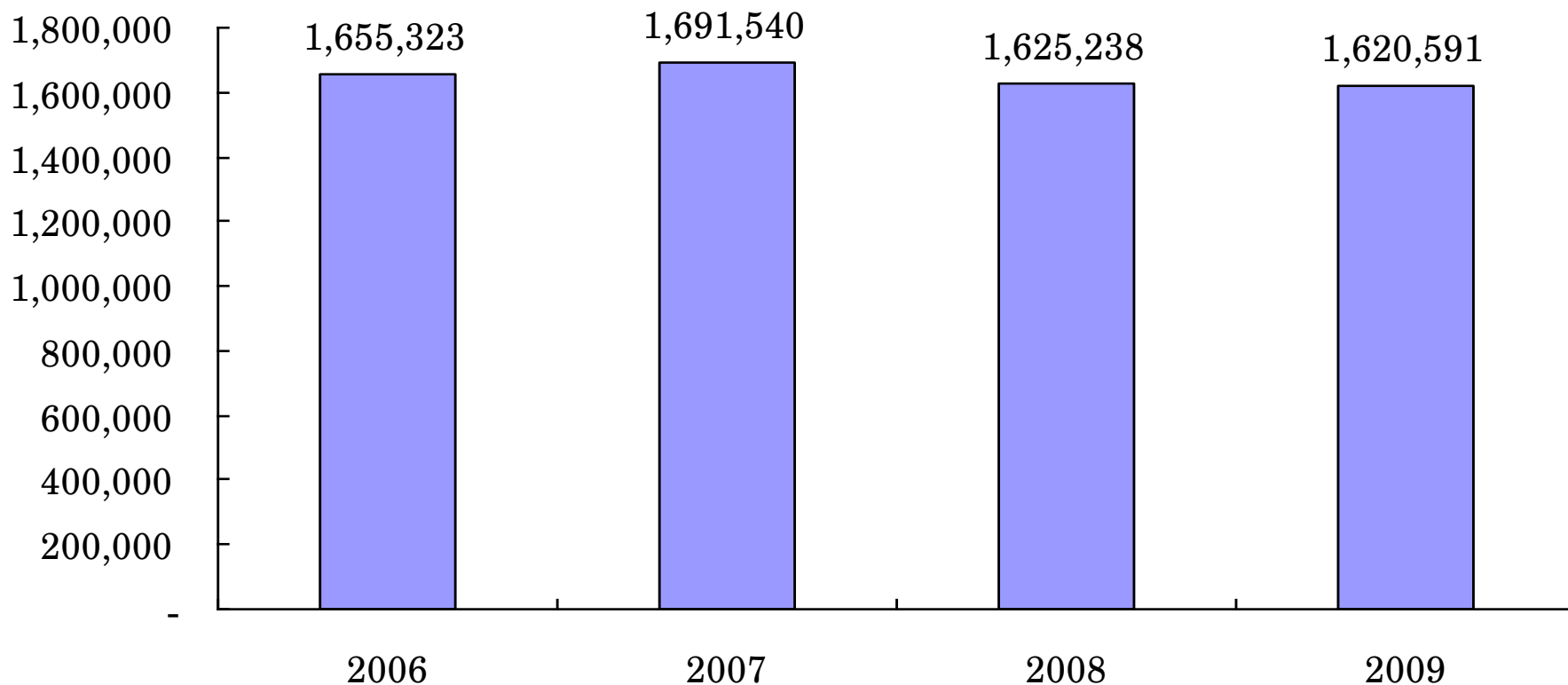
- Vegan buffet  
→ Chinese meal with 100+ dishes
- Thai Food
- Hot Pots
- Noodle Shop
- Traditional Taiwanese food
- Japanese Style
- Korean Style
- And more ...  
→ Overall total with 200+ dishes



# Vegetarian Food Court



# Meals served at Vegetarian Food Court



# Number of meals served

2006 ~ 2009 (4 Years)

- Patients' meals: 500,765 meals
- Vegetarian Food Court : 6,592,692 meals
- Total meals served: 7,093,457 meals



# Calculating the climate impact of meats

Meat type	Red meat (pork, beef)	Poultry	Sea food
GHG emission (kg CO <sub>2</sub> /kg product) (A)	19.7	4.3	8.5
Average proportion of Taiwanese meat consumption (B)	49%	16%	35%

## CO<sub>2</sub> for 1 kg meat consumption:

$$19.7 * (0.49) + 4.3 * (0.16) + 8.5 * (0.35) = \underline{\underline{13 \text{ kg CO}_2}}$$

(A): data from Carlsson-Kanyama and Gonzalez, Am J Clin Nutr (2009)

(B): data from Taiwan's National Nutrition Survey (2005 ~ 2008)



# Effects on carbon foot print

CO2 equivalent emission calculation:

1kg of meat → average 13kg CO2

An average meal in an omnivorous food court in Taiwan contains 100g (or 0.10 kg) meat per meal

- 7,093,457 meals \* 0.10kg meat = 709,346 kg meat
- 709,346 kg meat \* 13kg CO2/kg meat = 9,221,498 kg (or 10167 tons) CO2.
- Average **2,305,375 kg (or 2542 tons) CO2 per year**

Tzu Chi General Hospital, Taipei Branch



# Conclusion

- Hospital vegetarian meals are acceptable to 70% hospitalized patients (11% vegetarians, 58% omnivores).
- Vegetarian Diet in one 900 bed teaching hospital in Taipei, Taiwan, reduced about 2.3 million kg CO<sub>2</sub> per year.
- Influences on later dietary habits of discharged patients warrant further investigation.
- Each individual, each family, and each hospital could be part of the solution!





# Welcome to

