

“Environmental Risk and Opportunity for China and the World”

中国和世界的环境风险与机遇

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Introduction

简介

I'd like to talk with you about environmental risk in our world. In particular, I'd like to talk with you about a grave, largely overlooked risk to our environment – which very quickly becomes a grave risk to China and to the Chinese people. It is not an academic risk, but a very real one. And a precisely parallel area of opportunity complements it.

我想跟大家谈谈我们这个世界中的环境风险。特别是，我想跟大家谈谈一种严重的、被大大忽视的环境风险 – 并且对于中国和中国人民来说，它将非常快速地成为一种严重的风险。它不是理论上的风险，而是一种非常现实的风险。并且，伴随着它的是一种精确并行着的机遇。

I'll start by setting out some basic facts on climate change, and some common misconceptions. Next I'll provide some risk analysis, describe some pragmatic opportunity for reversing climate change, and finish with some brief conclusions.

我将以气候变化的一些基本事实和常见的错误观念展开，之后我将提供一些风险分析，介绍一些逆转气候变化的务实的机会，并以一些简明的结论结束我的演讲。

In December 2010, world leaders convened in Cancun to agree on a new international treaty to stop global warming – but they failed. A similar summit in December 2009 Copenhagen also failed. Since then, China has experienced its worst climate disruption ever. Last summer, temperatures hit new highs in seventeen countries. The previous record was in 2007, with new highs in fourteen countries. So the trend is in the wrong direction. Worst of all, most climate experts estimate that few years remain before climate change becomes irreversibly catastrophic.

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2010年12月，世界领袖在坎昆试图就制止全球暖化的一个新的国际公约达成协议 – 但他们失败了。类似的峰会在2009年12月的哥本哈根也失败了。从那时起，中国经历了史上最严重的气候灾害。去年夏季，高温天气在17个国家刷新纪录。前一个记录是在2007年，14个国家的最高气温创记录。因此，这种趋势指向错误的方向。最严重的是，多数气候专家估计在气候变化演变成不可逆转的灾难之前，仅剩几年时间。

Yet China has been a leader in acting to address the world's climate crisis.² For example, while the world strains each year to accommodate about 80 million more people along with new greenhouse gas (GHG) emissions for which they are inevitably responsible, China leads the world in taking measures to stabilize population. Were other countries to follow China's example in offering family planning and choice, the world's climate crisis would be greatly eased.

然而，中国已经在解决全球气候危机的行动中成为领导者。例如，当世界为每年新增的八千万人口及其带来的不可避免的温室气体排放增量而不堪重负时，中国在采取措施稳定人口方面领导了世界。如果其他国家学习中国的榜样，提供家庭计划及选项，那么世界气候危机将大大缓解。

China's new Five-Year Plan promises to accelerate China's "green transition," which will be critical in enabling China to implement its target of a 40 to 45 percent reduction in GHG-intensity by 2020. Most commendably, this Five-Year Plan proposes a carbon tax, which will provide a mix of economic incentives and rewards for industries and individuals to address climate priorities. Such a tax promises to accelerate the phase-out of coal over the long term.

中国新的五年计划承诺将加速中国的“绿色转型”，这对于确保中国在2020年之前实现将温室气体排放强度降低40-50%的目标将是至关重要的。最值得称赞的是，这个五年计划建议征收碳税，这将为工业界和公众优先考虑气候因素的行为提供一个经济刺激和奖励的手段。长远看，此税收必将加速煤炭的逐步淘汰。

China will continue to be a world leader if it successfully acts on its goals. But even if it does, it will be insufficient to prevent climate disruption. And unfortunately, while climate disruption is predicted to cause grave harm to all countries, the country predicted to endure the most harm is China, at least according to one recent comprehensive study.³

如果中国成功地实施为实现其目标而采取的措施，将继续扮演世界领导者的角色。但即使如此，也将不足以避免气候灾难。并且不幸的是，气候灾难预计将给所有国家带来严重损害，但至少按照最近的一个综合研究报告，即将遭受最严重损害的国家是中国。

Now I'll briefly list a few common beliefs that are actually misconceptions. It is commonly believed that the only way to stop global warming is for the world to set as its highest short-term priority the replacement of fossil fuel usage with renewable energy and energy efficiency – even though this path has been pursued for twenty years with little success. This has led to another misconception – which is that world is now locked into climate catastrophe, which destines the Chinese people to be victims of GHG emissions attributable largely to rampant Western consumerism. I'll raise several other misconceptions in the course of this presentation.

² Ng, 2011.

³ Wheeler, 2011.

现在我将简要地列举一些常见的但实际上是错误的观念。大家通常相信遏制全球暖化的唯一途径是，将世界近期最优先需要解决的问题设定为使用可再生能源替代化石燃料并提高能源效率 – 尽管我们已经在这条路上努力了 20 年而没有成功。这已导致另一错误的观念 – 即，世界气候灾难现在已不可避免，这将注定使中国人民成为主要源于泛滥的西方消费主义所导致的温室气体排放的受害者。在此演讲的过程中，我将列举另外几个错误观念。

Risk Analysis

风险分析

A frightening risk of climate warming is that a one degree Celsius rise in temperature above optimum in a growing season is said to cause a 10% decline in grain yields.⁴ This is already happening in some regions. Yet some eminent experts are warning of a catastrophic four degree Celsius rise in global temperature this century.⁵ Preventing this is a priority for the world, in part because of the decline in grain yields that such rise in temperature would deliver.

气候变暖的一个可怕风险是，在谷物生长季节，气温相对最适宜温度升高 1 摄氏度，据说将导致减产 10%。这种现象已经在一些地区发生。然而，一些知名专家警告说在本世纪全球温度有可能上升灾难性的 4 摄氏度。防止这种情况发生是一个全球优先的议题，部分原因是此种升温将导致谷物减产。

Developing sufficient levels of renewable energy and energy efficiency to keep temperatures from rising more than two degrees Celsius is projected to cost eighteen trillion dollars and take decades to install⁶ – long past the several years that most climate experts estimate remain before the tipping point for climate catastrophe. Even an increase of two degrees Celsius in the world's average temperature is projected to cause grave harm. So it is unlikely that China – or the rest of the world – can stop climate catastrophe by focusing only on renewable energy and energy efficiency.

发展足够的可再生能源和提升能源效率以避免升温 2 摄氏度，预计将花费 18 万亿美元并需要几十年的时间安装 – 远远超过多数气候专家所估计的、在气候灾难临界点到来之前仅剩的几年的时间。即使世界平均温度上升 2 摄氏度预计也将导致严重灾害。因此，对于中国或世界其它地区来说，只将注意力放在可再生能源和能源效率上，不太可能阻止气候灾难。

The most commonly-used snapshot of the world's anthropogenic GHG emissions shows that shorter-lived ones account for only about 15 percent of total anthropogenic greenhouse gas emissions, when all gases are measured on a 100 year timeframe.⁷ The figure for shorter-lived gases is significantly higher when each one is measured on a timeframe that more closely matches its half-life – which, for example, is about 10 years for methane. This fact is sometimes interpreted as raising the importance of addressing shorter-lived gases. However, such an interpretation does not account for a dramatic factor that is missed when one considers only the commonly-used snapshot of GHG emissions.

在一个常被引用的全球人类活动导致的温室气体排放图中⁵，当所有的气体被放在 100 年时间框架内计算时，短寿命气体大约只占人类活动导致的温室气体总排放量的 15%。当每种短寿命温室气体被放在与其半衰期更相近的时间框架内计算时 – 比如，对甲烷来说 8 至 12 年，其所占份额显著提高。这一事实有时

⁴ Brown, 2011.

⁵ New et al., 2011.

⁶ International Energy Agency, 2010.

⁷ See the chart at <http://www.wri.org/chart/world-greenhouse-gas-emissions-2000>

被解释为我们应更关注解决短寿命温室气体的重要性。尽管如此，当我们思考此常被引用的温室气体排放图时，这种解释也不能替代另一个常被忽略的重要因素。

One reason why a dramatic factor in GHG emissions gets overlooked is that people examining GHGs tend to focus on individual gases instead of patterns and systems. In another field – that is, the field of nutrition and public health – a parallel misconception was detected by the internationally respected Dr. Junshi Chen, now senior research professor at the Chinese Center for Disease Control and Prevention, in his work with Dr. T. Colin Campbell. Drs. Chen and Campbell are the lead authors of the well-known China-Oxford-Cornell diet and health project, partly funded by the Government of China, and popularly called the China Study.⁸ Before undertaking that project, Drs. Chen and Campbell saw that most studies of nutrition and public health focused on individual nutrients. Yet often, some studies of one individual nutrient would reach very different conclusions than other studies of the same nutrient, so sound results were difficult to discern.

温室气体排放的这一重要因素被忽视的原因之一是，当人们检视温室气体时，趋向于将注意力放在一个个单个气体而不是其模式和系统。在另一领域 – 营养学和公共健康领域 – 一个相似的被忽略的情况被享有国际声誉的中国科学家陈君石先生，现任中国疾控中心高级研究员，和柯林 坎贝尔先生在研究工作中被发现，当时这两位学者是领导中国-牛津-康奈尔饮食和健康研究项目的科学家，此项目通常被称为“中国健康调查”。在进行这个项目之前，陈医生和坎贝尔发现多数关于营养和公共健康方面的研究只注重单个营养素的研究。甚至，经常出现的情况是，对某一营养素的一些研究会与对同一营养素的另一些研究得出非常不同的结论，因此很难分辨真实可靠的研究成果。

Conversely, Drs. Chen and Campbell used an epidemiological method in their China Study, focusing on dietary patterns rather than individual nutrients. This led them to uncover a significant result that had been largely overlooked – namely, a strong correlation between consumption of livestock products (that is, meat and byproducts) and chronic degenerative diseases such as coronary heart disease and cancers. They attributed a low level of such diseases in rural China mainly to the traditional Chinese diet followed in those regions. By calories, this diet contains about 20% animal-based foods to 80% plant-based foods, compared to a ratio of about 50 to 50 in a typical American diet. The traditional Chinese diet contains about 1 percent of its calories in the form of animal protein versus about 10 percent in a typical American diet.

相反地，陈医生和坎贝尔在他们的“中国健康调查”研究中，使用流行病学的方法，注重研究饮食模式而非单个营养素。这一方法引导他们揭示了一个被极大忽略了的重要发现 – 即，畜牧产品(即，肉类及其副产品)的消费和慢性退变性疾病之间的紧密关系，如，冠状动脉心脏病和癌症。他们将这些疾病在中国农村的低水平发病率归因于这些地区的传统中国饮食。按热量计算，这种饮食包含大约 20%的动物性食物和 80%的植物性食物，而在典型的美式饮食中此比例是 50%对 50%。传统的中国饮食中，大约 1%的热量以动物蛋白的形式存在，而典型的美式饮食中此比例为 10%。

When I served as lead environmental advisor at the World Bank Group, my colleague Jeff Anhang and I invited Drs. Chen and Campbell to present the results of their China Study to World Bank Group staff, in 1997. The China Study inspired Jeff Anhang and me to think that it provided a rationale for looking at patterns and systems in the environmental impacts of livestock, rather than focusing on individual species or sites, as do most environmental studies of livestock.

⁸ Chen J. et al., 1990.

当我在世界银行集团任首席环境顾问时，我的同事 Jeff Anhang 和我于 1997 年邀请陈医生和坎贝尔就他们的“中国健康调查”的研究成果，来为世行员工做演讲。“中国健康调查”启发 Jeff Anhang 和我去思考，我们认为它提供了一个在为畜牧业做环境影响评价时，寻找其模式和系统的基本原理 – 而不是如多数有关畜牧业的环境研究中所做的，只关注单个品种或厂址。

While Drs. Chen and Campbell used epidemiology as their methodology, we used somewhat parallel methods in the environmental world – namely, sectoral assessment and lifecycle assessment. We started with a sectoral assessment of the environmental impacts of livestock,⁹ which we first circulated within the World Bank Group, complemented by a series of speakers including Drs. Chen and Campbell. At the end of our speakers’ series, the World Bank published a new livestock strategy, which for the first time recommended that institutions "avoid funding large-scale commercial, grain-fed feedlot systems and industrial milk, pork, and poultry production."¹⁰

陈医生和坎贝尔使用流行病学作为他们的方法学选项，我们则使用在环境领域里相对“平行”的方法 – 即，部门评价和生命周期评价。我们的研究始于畜牧业环境影响的部门评价，并首先在世界银行集团内部传阅，此报告由一系列的演讲者做了补充完善，其中包括陈医生和坎贝尔。最后，世界银行发表了一个新的畜牧业策略，其中第一次建议各大金融机构“避免资助大型商业性，喂食谷物的饲养场系统以及工业化牛奶、猪肉、和家禽生产”。

We then moved on to a lifecycle assessment of the greenhouse gas emissions attributable to livestock. There, as in our sectoral assessment, and similar to the findings of Drs. Chen and Campbell, we found that livestock products had dramatic impacts that had been widely overlooked. We wrote up the results of our lifecycle assessment in a *World Watch* article – in which we estimate that livestock are responsible for at least half of all human-caused greenhouse gas emissions.¹¹

接下来我们进一步做了一个畜牧业温室气体排放的生命周期评价。其中，与部门评价的结果一致，并且与陈医生和坎贝尔的发现相似，我们发现畜牧产品的严重影响被广泛地忽视了。我们将生命周期评价的结果成文发表在“世界观察”杂志 – 其中，我们估计畜牧业造成的温室气体排放占所有人类活动导致的温室气体排放总量的至少一半。

Our article has become quite popular. For example, we have learned that it has been posted on the official climate change website of the Government of China.¹² Elsewhere, UNESCO has reported: "Goodland and Anhang [have] explained... what may be a large-scale paradigm shift in the approaches to mitigating climate change."¹³ Though our article critiques the UN Food and Agriculture Organization (FAO), it invited us to deliver presentations in Rome and Berlin.¹⁴ Chris Mentzel, CEO of

⁹ Goodland, 1999.

¹⁰ De Haan et al., 2002.

¹¹ Goodland and Anhang, 2009.

¹² A Chinese friend wrote: "I am very excited to tell you that your article has been posted on the Chinese Government's official Climate Change Website (<http://www.ccchina.gov.cn/cn/NewsInfo.asp?NewsId=20278>)... This is a huge honor, because only high-level Chinese policymakers' articles or speeches are allowed on the website. The website attracts millions of eyeballs every day."

¹³ UNESCO, 2010, pp. 14-15.

¹⁴ These presentations can be seen at <http://awellfedworld.org/sites/awellfedworld.org/files/pdf/FAOConsult12-09.pdf> and <http://awellfedworld.org/sites/awellfedworld.org/files/pdf/GoodlandFoodIndustryBerlinJan2010.pdf>.

Clean Energy Maui LLC, has written that our analysis persuaded him that a one percent reduction in meat production would have the same climatic effect as three trillion dollars of solar energy financing.¹⁵

我们的这篇文章已经变得很流行。例如，我们了解到它被发表在中国政府的官方气候变化网站上。在其他地方，UNESCO 联合国教科文组织报告说：“Goodland 和 Anhang [已经]揭示 ... 在遏制气候变化的方案中，什么选项可以作为大规模的范例式的转变方案。”尽管我们的文章批评了联合国粮农组织(FAO)，它还是邀请我们去罗马和柏林演讲。清洁能源 Maui 公司的 CEO, Chris Mentzel, 写道我们的分析使他确信，降低 1% 的肉类生产与在太阳能发展上投资 3 万亿美元具有相同的气候效益。

In 1999, the International Food Policy Research Institute (IFPRI) started reporting on a “Livestock Revolution,” in which demand for cereals would increase by 39 percent between 1995 and 2020, while demand for meat would increase by 58 percent. However, in 2011, IFRPI started reporting a scenario of up to 19.2% lower global meat consumption by 2030.¹⁶

1999 年，国际粮食政策研究所(IFPRI)发表文章描述了一个“畜牧业革命”，这将使谷物需求在 1995 至 2020 年之间增长 39%，同时肉类需求增长 58%。但是，在 2011 年，IFPRI 开始预测在 2030 年前，全球肉类消费最多可以降低 19.2%。

Some people have trouble believing that eating meat can cause the climate to change, let alone imperil humanity. But they may not know that the world’s population of land-based livestock has grown six fold since 1960, so close to sixty billion will be raised in 2010 – and that:

有些人难以相信吃肉会导致气候变化，更不用说会危及人类生存。但是他们也许不知道，从 1960 年开始，陆基牲畜数量已经翻了 6 翻，在 2010 年已经接近 600 亿头 – 并且：

- One quarter of land worldwide is now used for grazing livestock;
- 全球四分之一的土地现在用于放牧；
- One third of all farmable land is used for growing feed;
- 三分之一的可耕地被用于生产饲料；
- One fifth of the Amazon rainforest has been destroyed, five times the area of England, mainly for livestock and feed production; and
- 五分之一的亚马逊雨林已经被毁，相当于英国面积的五倍，主要用于牲畜和饲料生产；而且
- When rainforest is burned, not only are GHGs increasingly emitted, but also the world’s largest carbon sink is steadily shrunk.
- 当雨林燃烧时，不仅温室气体排放增加，还使世界上最大的碳汇体持续缩小。

The largest factor in our analysis is completely uncounted in commonly-used estimates of GHG emissions. It is the direct impact of livestock’s respiration – or its reflection in carbon absorption foregone in land set aside for livestock and feed production. This perspective is supported by an eminent team of scientists published in the journal *Science*, stating: “If... crops displace forest or grassland, the carbon released from soils and vegetation, plus lost future sequestration, generates carbon debt, which counts against the carbon the crops absorb.”¹⁷

¹⁵ Mentzel, 2010.

¹⁶ Rosegrant and Msangi, 2011.

¹⁷ Searchinger et al., 2009.

我们的分析中的最大因子，在常见的温室气体排放评估中完全没有被计算。这就是牲畜呼吸的直接影响 – 或与其对应的为牲畜和饲料生产而留出的土地先前所能吸收的碳。这一观点被一个著名的科学家团队在 *Science* 杂志上发表的文章所支持，文章写到：“如果...农作物取代森林或草原，来自于土壤和植物的碳排，加上丢失的未来碳封存，将产生碳债，这将抵消农作物所能吸收的碳。”

In our assessment, either carbon dioxide in livestock's breath or carbon absorption foregone because of land set aside for livestock and feed production must be counted. That's because reality no longer reflects the old model of the Carbon Cycle, in which photosynthesis was said to balance respiration perfectly. That made sense when there were roughly constant levels of respiration and photosynthesis on Earth. But respiration has increased exponentially with livestock – while raising these animals has caused a dramatic decline in the earth's photosynthetic capacity, along with large and accelerating increases in volatilization of carbon in soil. This reality seems evident in a table published by the FAO, showing that today's atmospheric carbon from the respiration of all organisms – along with oxidation and erosion of soil organic matter – exceeds the capacity of photosynthesis to absorb such carbon.¹⁸

在我们的评估中，或者牲畜呼吸排除的二氧化碳，或者为牲畜和饲料生产而留出的土地先前所能吸收的碳，必须被计算。这是因为现实情况不再能与碳循环的旧模型对应，在旧模型中，光合作用据说能完美地平衡动物呼吸。只有当地球上的光合作用和呼吸作用大体上维持恒定水平时，此模型才合理。但是呼吸作用已随牲畜数量呈指数增长 – 同时饲养这些动物已经造成地球光合作用能力的显著下降，并伴随着土壤中碳挥发的大量且加速增长。这种现实似乎在 FAO 发表的数据表中很明显，即，现在的大气中来自于所有生物呼吸作用产生的碳 – 和土壤有机质的腐蚀和氧化所产生的碳 – 超过光合作用所能吸收的碳。

The second-largest factor in our analysis is the effect of methane – which is much greater than commonly considered when it is measured on a timeframe that matches its half-life. Its half-life in the atmosphere is only about 10 years, as compared with at least 100 years for carbon dioxide. Therefore, measured over a 20-year timeframe, methane has a global warming potential 72 times that of carbon dioxide. This perspective is supported by four current and former scientists employed by Agriculture and Agri-Foods Canada, a Canadian Government department, who have stated: “The 20-year accounting period may be a better reflection of the time scale for the GWP [global warming potential] of CH₄ [methane] because of the growing urgency of global warming.”¹⁹ Yet the powerful influence of methane is often misunderstood.

我们的分析中的第二大因子，是甲烷的效应 – 当将其放在与其半衰期相近的时间框架中计算时，其温室效应比通常认为的大得多。与二氧化碳至少 100 年的半衰期相比，甲烷在空气中的半衰期只有大约 10 年。因此，以二十年的时间计算，甲烷的全球暖化效应是二氧化碳的 72 倍。这一观点被现在或先前工作在加拿大农业和农产品局，一个加拿大政府部门，的 4 名科学家所支持，他们写到：“鉴于全球暖化的紧迫性不断增加，二十年的计算期或许是一个能更好地反映甲烷 GWP(全球暖化效应)的时间尺度。”而且，甲烷的强大影响力经常被误解。

For example, some experts say that methane is the largest climate risk in livestock, and they prioritize measures for technical mitigation of methane attributable to livestock – while overlooking more important risks in livestock. They neglect the fact that technology to mitigate methane emissions from

¹⁸ FAO, 2006, Table 3.2.

¹⁹ Dyer et al., 2011.

livestock can normally achieve only about a 10 percent reduction in methane emissions, and that this technology is too expensive and impractical for most livestock.

例如，一些专家说甲烷是牲畜业中的最大气候风险，并推崇利用技术方法来降低牲畜的甲烷排放。他们不仅忽略了牲畜的更重要的风险，而且，他们没有看到降低牲畜甲烷排放的技术通常只能达到 10% 的效果，对于大多数牲畜来讲，其技术的成本也非常高，且不实用。

Some experts say that levels of methane attributable to cattle show that sustainable livestock production can be achieved simply by allowing the present trend of decrease in cattle production worldwide to continue, while industry replaces that cattle production with pork and chicken production, whose growth need not be limited.²⁰ However, this argument does not take into account carbon dioxide in the respiration of pigs and chickens or its reflection in carbon absorption foregone in land set aside for the production of feed for pigs and chickens.

一些专家说，牛的甲烷排放水平说明，可持续的牲畜生产可以简单地通过放任全球性的牛饲养数量降低这一趋势来实现，即业界用猪和家禽来取代牛，且它们的增长可以不受限制。但这一结论没有考虑到猪和家禽的呼吸所产生的二氧化碳，或者为猪和家禽的饲料生产而留出的土地先前所能吸收的碳。

The importance of livestock respiration is seen in the broadly consistent metabolic rate of cattle, pigs, and chickens alike. Each animal dissipates about two watts per kilogram to stay alive.²¹ To reflect that, a roughly constant amount of carbon dioxide per unit of weight of livestock is respired, regardless of species.

牲畜呼吸作用的重要性来自于牛、猪和家禽等动物的代谢率的广泛一致性。每种动物的每公斤体重需要消耗大约 2 瓦的能量以维持生存。或者说，单位体重的牲畜所呼出的二氧化碳量基本上是恒定的，与动物种类无关。

Transportation fuels accounted for about 6 billion tons of carbon dioxide in 2009. In comparison, carbon dioxide from the breath of livestock raised in 2009 accounted for about 10 billion tons of carbon dioxide. Not only are the approximately 10 billion tons of carbon dioxide from the breath of livestock in 2009 invariable regardless of animal type, but there are also billions more tons of GHGs that are more or less invariable from these aspects of livestock production:

2009 年交通运输所耗燃料大约排放了 60 亿吨的二氧化碳。相比之下，2009 年，饲养牲畜的呼吸排放了大约 100 亿吨的二氧化碳。不仅这近 100 亿吨二氧化碳排放与动物种类无关，而且还另有数十亿吨的温室气体排放也或多或少地与畜牧业生产的如下方面无关：

- GHGs from transporting each kg of livestock product;
运输每公斤牲畜产品产生的温室气体；
- GHGs from solid and liquid waste from livestock and their products;
牲畜及其产品所产生的固体和液体废物排放的温室气体；
- GHGs from the substantially higher amount of refrigerating, cooking, and packaging of meat versus alternatives; and
肉类在制冷、烹饪和包装方面的温室气体排放远高于其他替代品；并且

²⁰ Steinfeld and Gerber, 2010.

²¹ Calverd, 2005.

- GHGs attributable to carbon-intensive medical treatment of millions of cases worldwide each year of zoonotic illnesses (such as swine flu) and chronic degenerative illnesses (such as coronary heart disease, cancers and diabetes) are linked to the consumption of livestock products – but not to alternatives.²²

碳密集的医疗救治所排放的温室气体：每年全世界有数百万例的动物传染病(如禽流感)和慢性退变性疾病(如冠心病、癌症和糖尿病)的救治与牲畜产品的消费有关，而其替代品则无此问题。

Accordingly, about half the GHGs attributable to the lifecycle of livestock products are more or less invariable, regardless of the type of livestock. Therefore, while significantly more GHGs are attributable to beef than to other meats because of cattle’s grazing, feed, enteric fermentation, and manure management, that significance is much smaller than commonly thought – and no particular meat product is likely to have a GHG footprint more than 25 percent lower than any other.

相应地，畜牧产品的生命周期中一半的温室气体排放或多或少与牲畜的类型无关。所以，即使牛肉的温室气体排放，由于放牧、饲料、肠道发酵和粪便管理等，比其它肉类更高，但其程度远低于通常认为的 – 并且没有哪一种肉类产品的碳足迹有可能低于任何其它肉产品 25% 以上。

As a result, replacing beef with chicken and pork would not result in any appreciable slowing of climate change. This point merits emphasis. In recent years, China has allowed multinational food corporations to increase pork and chicken products in China on a large scale. This generates grave risk. While it may be difficult for people to comprehend the climate risk, they may find it easier to understand that the amount of grain required for producing any amount of food from livestock is much higher than the amount needed to feed people directly. This seems to contradict the thrifty aspects of traditional Chinese culture. While the world has managed to produce enough grain to feed both people directly as well as livestock, the world’s capacity to do so is predicted to decline as climate warming intensifies.

作为一个结论，用家禽和猪肉来取代牛肉，不可能有效缓解气候变化。这一点尤为重要。最近几年，中国允许跨国食品公司在国内大规模增产猪肉和家禽的产品。此做法产生巨大的风险。也许对于普通人来讲很难理解气候风险，但他们易于了解，生产一定量的牲畜食品所需谷物的数量远高于人类直接食用所需。这似乎也与中国传统文化中的节俭精神是相违背的。当世界需要努力生产足够的谷物来同时喂养人和牲畜时，可以预期世界的承受力会下降而气候暖化将进一步加剧。

China now imports about 80 percent of its soy beans – about 60 percent of the world’s soy bean production – mainly for livestock feed. Much of it is sourced from land in the Amazon and other forest regions, deforested specifically to create pasture for growing crops.

中国现在有 80% 的大豆需要进口 – 占世界大豆产量的 60% - 而这些大豆主要用于牲畜饲料。其中大部分都来源于亚马逊和其它森林地区的土地，这些林地特意被砍伐用来种植农作物。

The grave risks in deforesting the Amazon have apparently inspired the restaurant chain McDonald’s to announce recently that it would stop sourcing beef, as well as soy feed for its chicken products, from the Amazon forest region.²³ This is a beneficial first step, but does not go nearly far enough. In a press release, McDonald’s refers to “sustainable beef” – implying that by sourcing livestock and feed outside the Amazon forest region, they become sustainable, so consumers can feel comfortable eating even more

²² Russell, 2010.

²³ McDonald’s press release, 2011.

livestock products than they do already. But nothing is said in such marketing about the high GHG footprint of livestock products, or the much lower climate risk of alternatives.

砍伐亚马逊雨林的巨大风险，已经显而易见地促使麦当劳连锁餐厅在最近宣布将停止采购来源于亚马逊雨林地区的牛肉和用于肉鸡饲料的大豆。这是有益的第一步，但还远远不够。有媒体报道，麦当劳提出了“可持续牛肉”的概念 – 暗示采购源于亚马逊雨林地区以外的牲畜和饲料，他们将变成可持续的，因此消费者可以放心地食用比以往更多的畜牧产品。但是这些市场宣传并未提及牲畜产品很高的碳足迹，或其替代产品低得多的气候风险。

Opportunity

机遇

In our *World Watch* article, Jeff Anhang and I explain that almost the entire goal of recent climate treaty negotiations can be achieved by replacing one quarter of today's products deriving from livestock (e.g., cows, pigs, and chickens) with alternatives. This would allow forest to regenerate on the vast areas of land now set aside for cattle grazing and feed production for livestock. Regeneration of forest is the only known way to create new, large-scale capacity to sequester today's atmospheric carbon. If it is not sequestered, then it will take at least a century to dissipate. As a result, our case may be the only pragmatic one available to stop global warming in the 5-10 years that many climate experts believe remain before irreversible climate disruption.

在我们发表在《世界观察》上的文章中，据杰夫·安航和我的分析，最近气候谈判的减排目标，几乎完全可以通过用替代品替代 1/4 的现在消费的畜牧产品(如牛、猪和鸡)来实现。这将使大面积的用于放牧和饲料种植而被砍伐的森林得以恢复。而恢复森林是建立新的大规模碳汇能力的唯一已知途径。如果这些碳不能被吸收，那么至少需要一个世纪的时间才能消解。作为一个结论，在 5 至 10 年时间里，我们的方法可能是遏制全球暖化的唯一实用的方法，而许多气候专家相信，这段时间是在不可逆转的气候灾难发生之前我们所仅有的。

China has commendably become a world leader in halting deforestation within its borders. Climate risk would be lowered if other countries were to follow China's lead in this area.²⁴ However, GHG emissions and climate change are transboundary, meaning that they do not respect borders.

中国在其境内阻止森林砍伐的成效，几经走在世界的前列，值得称赞。如果其它国家也能在这一领域仿效中国的榜样，那么气候风险将会降低。毕竟，温室气体排放和气候变化是跨越国界的，即它们不会遵守国界规则的限制。

As long as countries such as Brazil continue not to stop and reverse deforestation, there is a need for countries – where possible – to go beyond just acting to halt deforestation within their own borders. Accordingly, there is an urgent need for the Government of China to phase out its imports of livestock products and feed from countries where livestock and feed production are responsible for significant amounts of deforestation – and where continued production does not allow for forest to regenerate (as in Brazil).

只要像巴西这样的国家继续不停止和逆转森林砍伐，就需要其它国家，在可能的地方，采取进一步行动，而不仅仅是停止自己国内的森林砍伐。因此，中国政府急需逐步停止从这些因牲畜和饲料生产而大量毁林的国家进口牲畜产品和饲料 – 并且继续这种生产不可能使森林恢复(比如在巴西)。

²⁴ Cf. Stern, 2009.

Multinational food corporations act as if they do not know that China's traditional diet is possibly the best in the world – considering its environmental, social, and economic sustainability, as well as its taste. If the world followed China's traditional diet, its climate problems would be largely addressed, at least in the short term. Further, if the world followed China's traditional diet, there would probably be no problem in feeding the world's 9-10 billion people expected by 2050.

跨国食品公司的作为好像他们不知道中国的传统饮食 - 就其环境、社会和经济的可持续发展以及口味而言，或许是世界上最好的。如果世界都仿效中国的传统饮食，气候问题将至少在短期内在很大程度上得以解决。此外，如果世界都仿效中国的传统饮食，要养活到 2050 年预计的 90 到 100 亿世界人口很可能就没问题了。

Instead, many of the world's population who are not already eating diets intensive in livestock products are moving in that direction. Reversing the present trend could be the key to addressing climate change in the next 5-10 years. It could also be the key to addressing health and economic risks – as consumption of livestock products and associated illnesses have gone beyond their former association with affluence to become now also associated with poverty, in a phenomenon dubbed by some “the New World Syndrome.”²⁵

然而，世界上许多本来没有食用高强度畜牧产品的人口，现在反而朝着这个方向发展。扭转目前的趋势是未来 5 到 10 年应对气候变化的关键。这也是解决健康和经济风险的关键 - 因为畜牧产品的消费和与之相关的疾病已不限于先前只与富贵相关，现在也变成与贫困相关，这种现象被一些人称为“新世界综合症”。

Where people don't know of China's traditional diet, or they know of it but anyway have formed habits around eating meat and dairy products, they can replace those products with substitutes such as seitan-based "chicken," soy-based "beef," nut-based milks, and coconut-based ice cream. These are the types of products that companies such as McDonald's should be marketing as sustainable foods, rather than beef and chicken products.

对不了解中国传统饮食的人们，或者人们了解，但是已经形成了以食用肉奶制品的饮食习惯，他们可用像面筋做的“鸡”，大豆做的“牛肉”，果仁奶和椰子冰淇淋来替代肉奶产品。这应是像麦当劳这样的公司应该作为可持续食品推销的产品种类，而不是那些牛肉和鸡肉产品。

People may not recognize it, but their habits tend to be induced by fiscal measures and marketing, which strenuously promote meat and dairy products. Fiscal measures and marketing can promote alternatives instead. And trying tasty new foods is normally considered desirable. A carbon tax properly applied to livestock products would help to encourage better diets, while discouraging deforestation for livestock and feed production.²⁶

人们可能没认识到这一点，但他们的习惯往往受极力推销肉奶产品的财政手段和市场营销的诱导。财政手段和市场营销也可以推销肉奶的替代品。而且试尝美味的新食物通常被认为是可取的。对畜产品适当征收碳税将有助于鼓励良好的饮食习惯，同时阻止畜牧业和饲料生产造成的毁林。

²⁵ Shell, 2001.

²⁶ The world average meat consumption was about 40 kg/cap/year in 2000, with USA's at 120 kg, OECD countries at about 80 kg, while China's is now rising above 50 kg. According to one estimate, a tax on meat equivalent to 60€/ton of carbon dioxide (far less than half the current petrol/gasoline taxes in many European countries) would reduce beef consumption by about 15 percent (Wirsenius et al., 2011).

Meat and dairy substitutes can be promoted like digital technology. Within a decade, manufacturers have switched almost entirely from analog televisions and telephones to digital versions – propelled by savings in materials and energy use, along with other improvements. Like digital technology, meat and dairy substitutes can deliver better quality at lower cost, while fulfilling the world's priority of preventing climate disruption.

肉奶替代品可以像数字技术一样得到推广。十年内，为节约材料和能源，和其它方面的改进，制造商已几乎完全从生产模拟电视和电话转向数字电视和电话。像数字技术一样，肉奶替代品能以更低成本提供更佳质量，同时实现防止气候灾难的世界首要任务。

Most land used for livestock and feed production can regenerate forest. In woody vegetation and the soil beneath, much more carbon can be sequestered than in grasslands now set aside for grazing and feed – as much as the increase in atmospheric carbon since 1980, according to James Hansen, the US government's top climate scientist.

大部分用于畜牧业和饲料生产的土地可再造森林。美国政府的首席气候科学家詹姆斯汉森指出，木本植被及其下土壤所能隔离的碳远远多于目前为放牧和种植饲料而开辟的草原土地，并与自 1980 年以来大气中增加的二氧化碳相等。

Some argue that millions of poor people have no alternative to raising livestock for their livelihoods. But tens of millions of poor people's livestock have died recently due to climate disasters. Replacing them would risk a similar fate for the new animals. Supporting new livelihoods for those whose livestock die in climate disasters would be less risky. Microfinance, mobile banking, computers, and off-grid electricity have generated dramatic growth in many poor rural communities.

有人认为数百万贫困人口除了饲养牲畜别无其它生计。但是穷人们数以千万计的牲畜最近由于气候灾害而死亡。更新的新动物们将面临遭受同样命运的危险。支持在气候灾害中损失牲畜的人们开辟新的生计风险会小的多。小额信贷、手机银行、电脑和离网发电已使许多贫困农村社区得以显著发展。

Agriculture is outdoors to a unique degree, exposing it to greater risk from livestock-related emissions than any other industry's risk from the same emissions. So food industry leaders have a compelling commercial incentive to reduce these emissions. Meat and dairy substitutes require no subsidies or offsets. Consumers can buy more of them tomorrow.

由于农业是独特的室外程度很高的产业，其来自于畜牧业的排放，使其面临的风险比其他任何行业发生相同的排放都大。因此，食品行业的领导者有不可抗拒的商业动机去减少这些排放。肉奶替代品不需要补贴或补偿。将来消费者会购买更多的肉奶替代品。

Conclusions

结论

According to Lester Brown, founder of the Worldwatch Institute, the environmental think tank that published our livestock-climate analysis, worldwide anthropogenic GHGs can and should be cut by 80 percent by 2020. To do so, practically all means will be needed simultaneously: (a) revenue-neutral carbon or GHG emissions taxes applied domestically and to imports, including livestock products and feed; (b) prompt phase out of coal (unless its GHG emissions are sequestered); (c) prompt repeal of subsidies for agrifuel from oilseeds and grain; (d) population stability; (e) vigorous transition to renewable energy; and (f) large-scale regeneration of forests together with tree planting. Among these measures, only regeneration of forests and tree planting could actually increase absorption of

atmospheric carbon on a large scale as is desperately needed. Probably the only way this can occur is by replacing a significant amount of livestock products with alternatives.

发表了我们关于畜牧业与气候分析报告的环境智库，世界观察研究所，其创始人莱斯特·布朗(Lester Brown)认为，全球人类活动导致的温室气体排放可以且应该在 2020 年削减 80%。为此，实际上需要同时实施所有方法：(a)对国内生产和进口的畜牧产品和饲料征收碳或温室气体排放税；(b)尽快启动逐渐淘汰煤炭的过程(除非其温室气体排放可隔离)；(c)尽快废除对使用油料作物和谷物提炼生物燃料的补贴；(d)稳定人口；(e)积极向可再生能源过渡；并且 (f)大规模植树并恢复森林。在这些措施中，实际上只有恢复森林和植树可以大幅度地增加碳汇，这也是非常急需的。或许，我们唯一可能成功的方法是使用替代品大量替代牲畜产品。

In addition, our recommendation of a 25 percent replacement of livestock products with alternatives could liberate as much as 40 percent of current world grain production. This would be enough to provide adequate calories and nutrients for more than 3 billion people, an important objective if the projection of a worldwide population of 9-10 billion by 2050 is fulfilled. It would also make possible significant reductions in GHG emissions from forest fires and concomitant biomass decay, which inevitably accompany expansion of livestock and feed production. It would also result in less livestock-related methane from manure and from ruminants' enteric anaerobic digestion.²⁷ Given the relatively short half-life of methane and its high global warming potential, this would add to the short-term reduction in atmospheric carbon available from regeneration of forest on land set aside for livestock and feed production.

另外，我们推荐的使用替代品替代 25%的牲畜产品的方法，可以节约 40%的世界粮食产量。这足以为至少 30 亿人口提供充足的热量和营养，对于一个在 2050 年人口预期将达到 90 至 100 亿的世界来说，这是一个需要完成的重要任务。此方法还将可能实质性地降低来自于燃烧森林的温室气体排放及其伴随的生物数量衰减，而这种现象是扩大畜牧产品和饲料生产所不可避免的。此方法还将使来自牲畜粪便和反刍动物肠道厌氧消化过程所排放的甲烷减少。考虑到甲烷相对短的半衰期及较高的温室效应，通过在畜牧业和饲料种植所占土地上恢复森林，将使我们在短期内增加碳汇。

Renewable energy must still be increased on a large scale to keep emissions and atmospheric carbon down over the long term. But in the near term, China can become an even greater leader on climate change than it is today by implementing carbon or GHG taxes properly applicable to livestock products; by phasing out its imports of livestock products and livestock feed; and by vigorously revitalizing its traditional diet, possibly adding some new meat and dairy substitutes as a modern twist. After all, as described in this presentation, replacing livestock products with substitutes is the only way for governments, industry, and the general public collaboratively to take a single, powerful action to reduce climate change quickly.

从长远来看，可再生能源仍然必须大规模增长，以减少碳排放和大气中的碳。但从近期看，中国甚至可以通过实施以下政策而成为气候变化领域的一个更重要领袖，如适当地对牲畜产品征收碳税或温室气体排放税、逐步停止牲畜产品及饲料的进口、努力恢复传统饮食，当然也还能增加一些新的肉和奶替代品。最后，如前所述，使用替代品替代牲畜产品是政府、工业界和公众共同快速遏制气候变化的唯一简单有效途径。

²⁷ The global livestock chain is commonly said to be responsible for 65 per cent of the nitrous oxide (mainly from manure), 37 per cent of the methane, 64 per cent of the ammonia, and nearly 80 per cent of all agriculture-related emissions.

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