

边境棕地： 后工业及后冲突棕地景观

BROWNFIELD BORDERS: POST-INDUSTRIAL AND POST-CONFLICTING BROWNFIELD LANDSCAPES

1 引言

不论是在政治、文化、舆论层面，还是在政府秘密会谈中，当前朝鲜半岛的统一进程受到了世界各方的密切关注。早先对韩朝非军事区（Demilitarized Zone，简称DMZ）的研究主要视其为一个未受人为干扰的生态保护区，这里拥有连绵起伏的山地、森林、田野、河流等自然美景，也充斥着人为制造的恐怖——森严的防御工事、地雷、铁丝网和禁止双方公民往来的边境防线（图1，2）。然而，该区域两侧政府当前的规划都未关注过这片棕地以及棕地对当地居民健康与景观状况的影响。双方政府后期的任何（为使这片区域重新适宜人居的）改造计划都应在地雷的清理，军事装备、掩体和部队建筑物的拆除，以及军需品、农药、石油和石油产品储存区的改建等为核心。改造工作将涵盖受污染的水体（河、湖、溪等）、沉积物和土壤的修复，在丘陵和谷地植树造林，以及铁路、公路和水坝等基础设

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摘要

朝韩边境的非军事区（DMZ）是当今世界危险系数极高和防御工事极强的区域。过去70年间，军队与军用设施持续而密集的驻扎、大量军事防御设施及经年累月的军事污染，在分裂的朝鲜半岛上形成了一连串的棕地。未来，朝韩有望实现政治与社会统一，这意味着将来有关半岛统一后的所有景观问题都需要在朝韩非军事区内解决。相关工作包括对区域内的陆地、水体以及现存军事基础设施和废弃设备进行详细分析；土壤修复、地下水与排水系统修复以及棕地再利用问题；新型制造业的引入、地区旅游业的发展，以及传统或新型能源的开发等。朝韩非军事区棕地可以视作传统后工业棕地（通常位于城市或城市边缘、以棕地再生方法与惯用手法进行处置）的一种极端情况。甚或说，“边境棕地”是一种全新棕地类型，无论是场地自身还是场地中的污染及污染治理方法都是非常独特的，需要开展持续的修复与再利用。本文旨在通过哈佛大学研究生设计课程对朝韩非军事区中开展学术研究，聚焦于朝鲜半岛的统一、作为新型棕地实践的边境景观修复举措，以及针对场地多种可能未来的规划设计方案。

关键词

边界；边境棕地；修复技术；军事防御区；军事棕地；雷区

ABSTRACT

The Demilitarized Zone (DMZ) landscape between the Democratic People's Republic of Korea and the Republic of Korea is currently the most dangerous and heavily fortified territory in the world and has produced a series of continuously linked brownfield lands on a divided Korean Peninsula through the continued intense presence of military troops and equipment, a significant amount of defense infrastructure, and pollutant buildup over the last seventy years. The political and social reunification of the two Koreas may occur in the coming years and any work in the future to address the landscape of a unified peninsula would be required to carry out in the DMZ. The work includes a complete characterization of the land area and water bodies and the existing military infrastructure and abandoned equipment, with the proposed remediation of soils, groundwater, and drainage systems as well as the concerns of brownfield land reuse, adding new industrial manufacturing to the area, the increase of tourism into the region, and the development of both traditional and new forms of regional energy generation. The brownfields in the DMZ can be considered an extreme version of the more conventional post-industrial sites that are addressed in other urban or ex-urban venues through the methods and conventions of brownfield regeneration. Or indeed it may become a new type of brownfield site — the “brownfield border” — with its own characterization, on-site pollutants, and methods to address its ongoing remediation and reuse programs. The intention of this paper is to examine the DMZ through a recent academic study carried out through a graduate design studio at Harvard University focused on the outcomes of unification on the Korean peninsula, the remediation of border landscapes as a new type of brownfield practice, and potential planning and design of alternative futures.

KEYWORDS

Boundaries; Brownfield Borders; Remediation Technologies; Military Defense Sites; Military Brownfields; Minefields

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- ① 民用控制区的设定是为限制和控制民众进入该地区，以保护、维护设施的安全，其军事目的是保卫DMZ，并管控居民在其南部界线附近的活动。
- ② 北方限制线是1953年联合国军司令部在朝鲜半岛西海和东海划定的边界线（海域边界），用于界定和限制海上和空中巡逻活动。
- ③ 随着1953年7月27日《朝鲜停战协定》的签署，三八线冲突悬而未决，朝鲜同意以军事分界线为中心线各向南北撤军2km。
- ④ 板门店是位于韩朝边界上的一座村庄，毗邻1953年《朝鲜停战协定》的签署地。

施的建设等。除高强度军事用途外，此处棕地已空置70余年，其重新利用与再工业化都将对设计提出极大挑战。

2 哈佛大学朝韩非军事区主题设计课

2018年春季，笔者与来自韩国首尔的景观设计师、兼任哈佛大学联合设计导师的金正允和朴允珍合作，共同指导哈佛大学设计研究生院的13名研究生进行以DMZ及其腹地地区为研究对象的设计课程。2018年3月，课程组织学生前往DMZ及其腹地的部分区域以及民用控制区（Civilian Control Zone）^①，对棕地进行了现场勘察和分析，并构想了针对这一举世瞩目的高敏感区域的修复方案。从棕地的角度来看，整个区域在经过60多年的高强度军事用途后受到严重污染，特别是土壤中残留了弹片、油渍、金属等污染物，以及双方多年前埋下的300多万颗未引爆地雷。唯有通过极具针对性与创造性的规划和设计方案，才能全面彻底地修复这片“棕色国土”。

这一名为“半岛重生”（Korea Remade）的设计课旨在激发学生探索如何通过生态学、修复技术、对污染土地展开场地规划和再生设计等举措推动未来朝鲜半岛的统一。课程体现了哈佛大学设计研究院一种具有代表性的教学方法，鼓励通过结构化的方法来构思、设计、深化棕地再生的新途径。

这种教学和探究棕地修复及再利用的方法可能是规划和设计专业中所独有的，能够催生出一系列极具创造性且切实可行的解决方案。对于参与该课程的学生和教师而言，课程最大的吸引力在于其以棕地规划设计为研究和创新的媒介，而非从政治、立法、人道主义或军事环境等角度入手来探讨统一进程。此外，这种“统一进程”首先需对场地的地质、水文和土壤以及自然和人工修复方法进行研究、描绘和表达，而当前构建新基础设施、新生态和新社区的惯常方式或难以施行。总结而言，该课题主要建构于通过恢复（修复期间和修复后）DMZ及其腹地的宜居性来推动朝鲜半岛的统一。

3 研究区域

针对DMZ的各类设计方案层出不穷，例如将DMZ及其周边更广大的区域以国家公园、自然保护区、世界和平纪念地或朝鲜战争遗址等方式进行保护。但不可否认，DMZ所在片区的军事行动连年不绝，导致当地作业危险性高、资源利用不当、场地污染严重。联合国环境署的报告显示，以往和当前的军事行动已污染地下土壤和水体，而且边境巡逻行动已造成多处大面积的植被焚毁。

DMZ东西长约250km、南北宽约4km，是该片区内体量较大且极为重要的一块棕地。其大小相当于250个纽约中央公园，或优山美地国家公园的三分之一。与这两处地标一样，DMZ也具有极高的景观价值。然而，DMZ大部分片区都禁止公众入内；即便得以进入，限制条件也非常严格。整个DMZ的棕地内遍布各类有机和无机污染物，其中有一种特殊的污染物，即杀伤性地雷中的化学物质会随时间推移不断泄漏，并逐渐渗入地表径流和沉积物中。

20世纪50年代，朝鲜半岛上军事冲突不断，导致半岛上出现了各种边界、线路和区域，各地的污染程度也不相同。例如，北方限制线（Northern Limit Line）^②周围多为由海事造成的棕地，包括造船厂、油码头等。在DMZ的中央地带——军事分界线（Military Demarcation Line）^③，充斥着由军事设施产生的炸药、地雷和地下污染物的混合污染。民用控制区是毗邻DMZ南部边界的一个宽约10km的外层缓冲带，在不影响军事作战和保安的范围内，有约4万名居民经过授权得以进入并定居于此（现有81个村庄），可从事日常农业活动；该缓冲带内的棕地一部分是由农业生产中的杀虫剂和除草剂所造成，另一部分来源于溪流和排水渠中的地下和水体污染物。在板门店（Panmunjom）^④，日常的高强度军事活动带来了多种高浓度的污染，包括来自发电机和弹药的金属、油和致癌物质多氯联苯。

在初期，设计课对整个朝鲜半岛从地质、地理和国土的角度进行了分析研究，涵盖了当前朝鲜、韩国、两国之间的DMZ冲突带/边界，



1. DMZ景观环境和场地条件俯视图
1. Overview of the DMZ landscape character and conditions



2. 整个DMZ区域在经过60多年的高强度军事用途后受到严重污染。
 3. 学生考察DMZ
2. The entire area of DMZ is highly polluted after over sixty years of intense military use.
 3. Graduate students visiting the DMZ

及周边区域中网络化分布的防御工事、军队、安全传感器、电围篱、地雷区、地下隧道、村庄农业区，以及废弃的和另作他用的军事基地（如格里夫斯营地）、森林、河口和大片湿地等。学生们分组开展调研，通过对地表、地下水和区域含水层之间边界的断面研究，进一步了解了朝韩之间的污染、安全、边界、场地特质等问题。其后，每位学生以“另类自然”（Alternate Nature）为题就个人所选场地提出景观设计方案，利用地形、地被、种植重构及引入新的排水和交通基础设施，来探究棕地修复途径。

4 研究方法

在前期小组调研并探究DMZ及其腹地边界作为空间媒介在朝韩统一进程中的作用的基础上，学生们通过各自的设计方案来解读“另类自然”这一主题的景观概念和空间建构、探索如何应用更加自然的棕地修复技术、思考修复完成后如何合理组织场地功能，并探究“统一”背景下的经济可行性及其形式和空间特征。在复杂景观结构的条件限制下，学生们基于风险评估进行了规划定位：在未来10余年间，这一景观结构需要或能够适应重大的场地修复和物质空间改造。

对于呼应该地区的复杂历史并引导未来行动，助力消除边界、打破障碍，重构朝鲜半岛的生态环境而言，DMZ及其毗邻腹地的受污染地表既是场所，又是媒介，也是方法。这种途径拒绝采取过于简单化的景观保护策略（如将DMZ继续定位为禁止人类干扰的生态保护区），也反对任何毫无依据的建筑或艺术介入和孤立的项目建设，而提议将“统一愿景”（unification）用作一种信息化的、技术性的、空间层面上的景观工具，以积极应对场地上遗留的污染问题，并探寻重构人类聚居地和创新性景观基础设施及设计形式的可能，从而最终实

现重塑DMZ及其腹地地区生态环境的目标。这就需要在不断深化发展的景观设计过程中采用一系列修复技术，尤其是与土方迁移、地形塑造及河流水文工程相关的技术；同时引入新型用地开发，例如先进的清洁技术制造业与生产业，以提高无污染农业比重，在为濒危物种提供栖息地的同时，保障生态实验区的运行。设计课贯穿整个学期，共分为4个阶段。

（1）通向安全之地

课程首先研究了景观修复规划设计方案可能带来的影响，及其在边界划定、复杂土地利用格局分析方面的作用。其次，在军事设施和邻近腹地的关系中探讨了在物理空间上进行清理的可行性。此外，对爆炸品及军火燃料进行了专项研究。

（2）半岛重生

基于第一阶段的研究成果，第二阶段的目标是重新梳理和划定DMZ的棕地范围，及其与腹地 and 邻近地区的关系；同时对其他国家的军事或政治边界进行了案例研究。

（3）实地检验

在考察韩国、DMZ和周围环境及腹地的过程中，学生们对前两个阶段的成果进行了实地检验（图3），并参加了在首尔举办的工作坊，共同探讨了与朝鲜半岛未来发展和统一进程及其棕地基础设施相关的关键问题。

（4）建造“另类自然”

实地考察之后，学生完善了各自基于“另类自然”主题的棕地景观设计方案。以往对DMZ的研究认为该区域既有动人的美景，也恐怖得令人望而却步；本设计课程期望一改人们对DMZ的传统认知，并探索这一棕地在人类栖居、自然修复以及基础设施和能源的工程性再造等方面的机遇。

4. 学生顾然的设计方案总平面图。该方案希望使DMZ在实现统一后，不仅能够容纳迁居而来的人民，也能推动制造业、旅游业的发展，同时促进社会与文化的交流。
 5. 现状军事区域内各种棕地类型混杂，需要结合各种处理技术和广泛的生态规划方法来实现不同程度的修复和复原，以保障它们能够随着时间的推移最终得到重新利用。
4. Master plan of the design proposal by student Gu Ran that aims at accommodating migration of citizens, manufacturing goods, serving tourists, and facilitating social and cultural exchanges after unification.
 5. The current condition of the military zone are a mix of different kinds of brownfields that require varied levels of remediation and recovery through "treatment trains" and a broad set of ecological planning approaches for their ultimate reuse over time.



4 © 顾然 / Gu Ran [GSD, MLA 2018]

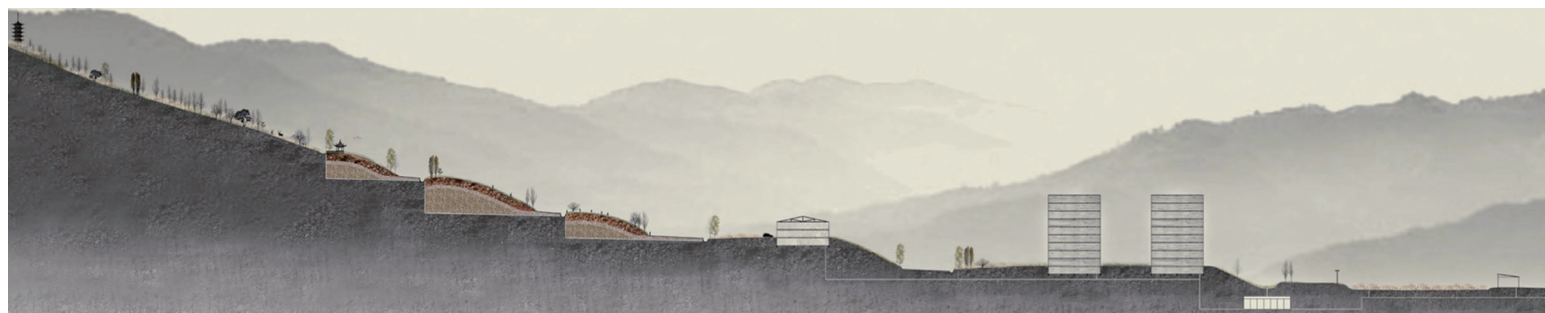
5 课程设计成果

此次设计课旨在基于国土和全球尺度探讨棕地修复和再生设计，所研究的区域在当今世界政治、经济、环境和再生层面均具有重大话题性。参与课程的学生们充分利用这一挑战，构思了与制造业和旅游业相关的创新性项目，进而以点带面，激活整个研究区域。下面简要介绍两位学生的设计成果。

学生顾然提议在场地上建立国家公园系统，并规划了两地统一后的区域结构。方案提议对原军事基地进行开发，使其不仅能够容纳迁

居而来的人民，也能推动制造业、旅游业的发展，同时促进社会与文化交流（图4）。

正如预期的那样，现状军事基地和军事区域内各种棕地类型混杂，需要结合各种处理技术和广泛的生态规划方法来实现不同程度的修复和复原，以保障它们能够随着时间的推移最终得到重新利用（图5）。场地中的弹药残余已达60余年，对土壤构成的威胁最为明显，特别是60cm以内的表层土壤。场地中的金属铸件不断老化和破裂，炸药也不断渗入土壤，亟需就地及在场外进行土壤清理和移出。此外，军需品也被储存在原基地的“处理堆”中。在深达3m的



5 © 顾然 / Gu Ran [GSD, MLA 2018]

不同土壤层中，高度扰动的垃圾堆不断聚积金属、油脂和环炸药成分三亚甲基三硝胺（RDX），又与有机土壤和建筑材料（如灰泥、砖和油漆制品）混杂在一起。这种混合污染物可通过异位修复技术进行处理，具体方法是对废料进行筛检和分类，处理土堆中污染最严重的部分，通过化学氧化去除油脂，并种植特定的植被来进行生物修复、降解RDX。该方案还关注了现有军事基地建筑物和基础设施的结构，建议清除墙壁和屋顶表面的石棉、含有多氯联苯的门窗胶粘密封剂，以及于1970年以前使用的木材和金属表面铅涂料的碎片。最后，项目将场地的现有结构和开放空间整合到更大尺度的景观之中，以更好地容纳非军事文化和社会活动（图6，7）。

另一位学生陈嘉雯为那些对“黑色旅游”感兴趣的游客开发了一个名为“朝韩50年”（Korea 50）的项目。“黑色旅游”泛指以与人类或生态悲剧甚至死亡联系在一起的景观或场地为目的地的旅行及旅游业，例如，废弃采矿区、位于欧洲和越南的战争遗址和灾害地（如乌克兰切尔诺贝利核电站遗址）等。因此，“朝韩50年”方案期望通过向游客开放战后遗址来获得旅游收入，以资助后续的场地扫雷行动——地雷的清除要先行于任何场地开发行动（图8）。目前，DMZ地下、沉积物和水体中埋设的地雷共约300万枚，2016年仅清除134枚地雷就花费了约100万美元^[1]（图9）。考虑到扫雷进程十分耗时且成本高昂，而DMZ中的生活基础设施和军事设施势必将存在冲突，因此“朝韩50年”项目在DMZ施行的可行性非常高。“朝韩50年”方案将以当地独特的地质与生态环境为媒介，利用战争遗迹（如战场废墟、隧道、瞭望塔、坦克陷阱等）来保存记忆。在该方案中，开发的场地

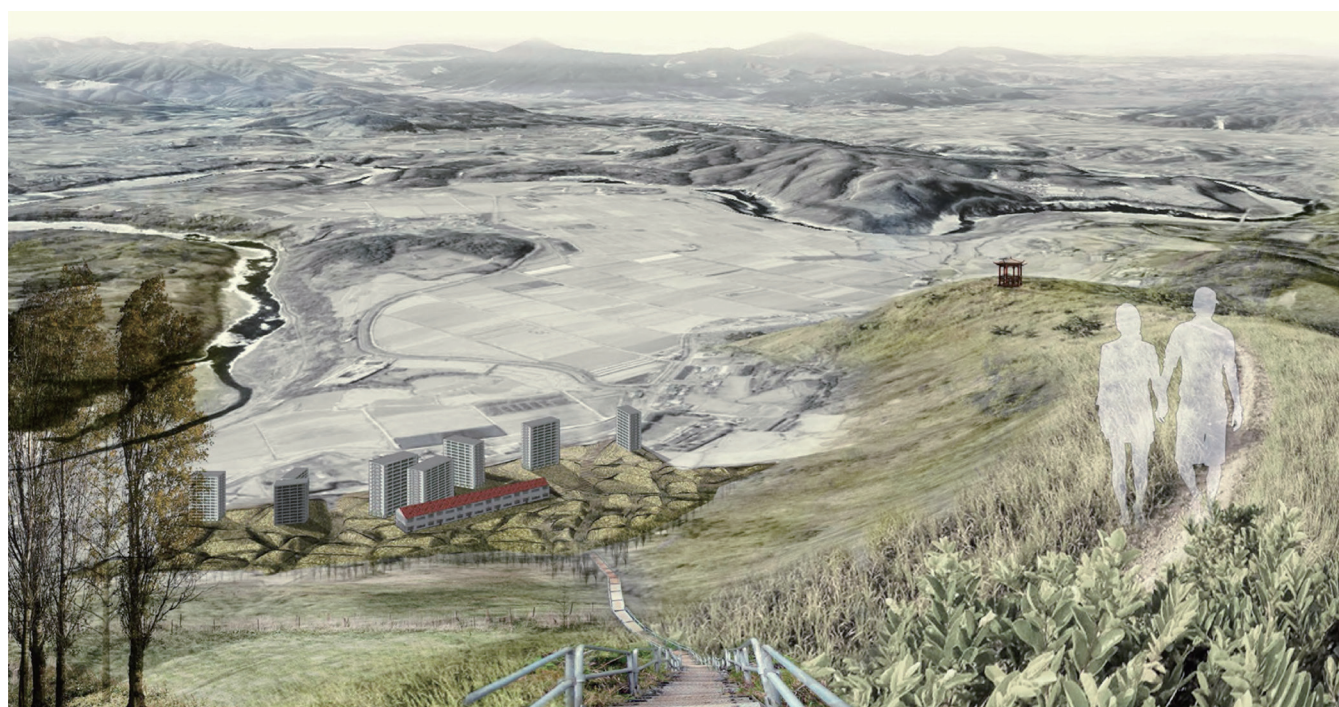
相对较小且较为分散，所以在起始阶段只需很少的投资和土地就可开展。随着时间的推移，“黑色旅游”的收入将为常规的扫雷行动提供资金，以此来开辟更多的土地用于其他类型的开发和常规旅游——理想情况下，这一目标可在50年内实现（图10~12）。

6 结语

当前已有众多国家政府在（历史）边境（包括曾经的东德与西德之间、爱尔兰共和国与英国之间，甚或印度与巴基斯坦之间）的条件、环境和军事技术设施以及遗迹改善等方面取得了重大进展。尽管这些边界在政治、社会和历史意义层面各不相同，但经历多年的军事活动后，它们在基础设施、土壤、水资源或沉积物等环境条件上却具有相似的特征。然而，国际上对此类军事边境棕地认知依旧不足，例如，世界各地、各国、各大洲乃至全球的边境棕地数量有多少；边境棕地的修复如何能够长久改变当地的经济和社区状况，包括那些因边境冲突而造成人类苦难和严峻环境后果的地方。本设计课研究中的棕地再利用和再生实例表明，经过环境修复、基础设施建设和长期的工程与设计举措，规划设计人员能够有效开拓后工业和后军事边界景观，从而为城市、区域、国家乃至更大范围的国际社会谋取福祉。LAF

注释

更多有关哈佛大学设计研究生院的研究与设计方案，可联系尼尔·科克伍德教授获取。



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① The purpose of the Civilian Control Zone is to limit and control the entrance of civilians into the area in order to protect and maintain the security of facilities. Its military purpose is also the defense of the ceasefire line and is necessary to monitor civilian travel destinations close to the Southern Limit Line of the DMZ.

6, 7. 方案将场地的现有结构和开放空间整合到更大尺度的景观之中，以更好地容纳非军事文化和社会活动。

6, 7. The proposal integrates the remaining structures and open spaces into a larger landscape accommodating non-military cultural and social programs.



1 Introduction

The unification process on the Korea Peninsula is currently the focus of intense political, cultural, and media attention around the world as well as private and confidential government meetings behind the scenes. Previous studies of the Demilitarized Zone (DMZ) between the Democratic People's Republic of Korea (DPRK) and the Republic of Korea (ROK) have viewed this zone as a pristine ecological reserve as well as a landscape of intrinsic beauty with rolling mountainous land, forests, fields, rivers and yet full of human terror — the heavily guarded, land-mined, and barbed wire infrastructure and defense military border denying movement of any citizens on both sides (Fig. 1, 2). Nowhere are the concerns of brownfield lands and their influence on the health and condition of the landscape and local citizens identified as most central to any government plans on either side of the zone. Landmine-clearance, the removal of military equipment, bunkers, and troop buildings, and supporting storage areas of munitions, pesticides, petroleum, and oil products, are central to any design proposals coming from either government (to make this entire territory habitable again for the surrounding communities). This will include the remediation of polluted rivers, lakes, streams, sediments, and soils; future reforestation of hills and valleys; the creation of the new infrastructure of rail, roads, and dams as well as the design challenges of the reoccupation and re-industrialization of a brownfield territory that has largely been vacant apart from the intense military presence for over seventy years.

2 DMZ Design Studio at Harvard

A landscape architecture design studio on the subject of the DMZ and Hinterlands was taught by the author in the spring of 2018 in collaboration with co-instructors Jung-yoon Kim and Yoon-jin Park, landscape architects of Seoul and design instructors at Harvard University, to a class of thirteen graduate students of Harvard Graduate School of Design. In March of 2018, the class was able to access parts of the DMZ and Hinterlands and the Civilian Control Zone^① to carry out on-site inspection and analysis of the brownfield conditions present and to imagine the possibilities of remediating and recovering this highly sensitive territory which is the focus of the world's attention. From a brownfield's point of view, the entire area is highly polluted after over sixty years of intense military use. In particular it is contaminated with munitions, petroleum, metals in the soils and over 3 million live land mines that were planted over the years by both sides. The land as a territorial brownfield requires very special and creative planning and design programs to initiate its overall and final recovery.

The Korea Remade Studio as it was called, advanced a range of alternative futures for a reunified Korean Peninsula through the concerns of ecology, remediation technologies, and site planning and design reuse of polluted land. This studio is a pedagogical method within the academy for graduate students to engage in a structured method of conceiving, designing, and developing new ways of looking at brownfields land reuse.

This method of both teaching and developing approaches

场地中的历史事件 Historical interference

1910~1945 朝鲜日据时期 Japanese Korea
 1950~1953 朝鲜半岛战争 The Korean War
 1953~1962 战后冲突 Post-war incidents
 1962~2010 城市化与农业发展 Urbanization and agriculture
 2010~ 其他冲突 Threats

0 400 800 1600m

DPRK

38°

ROK

城市化发展
Urbanization

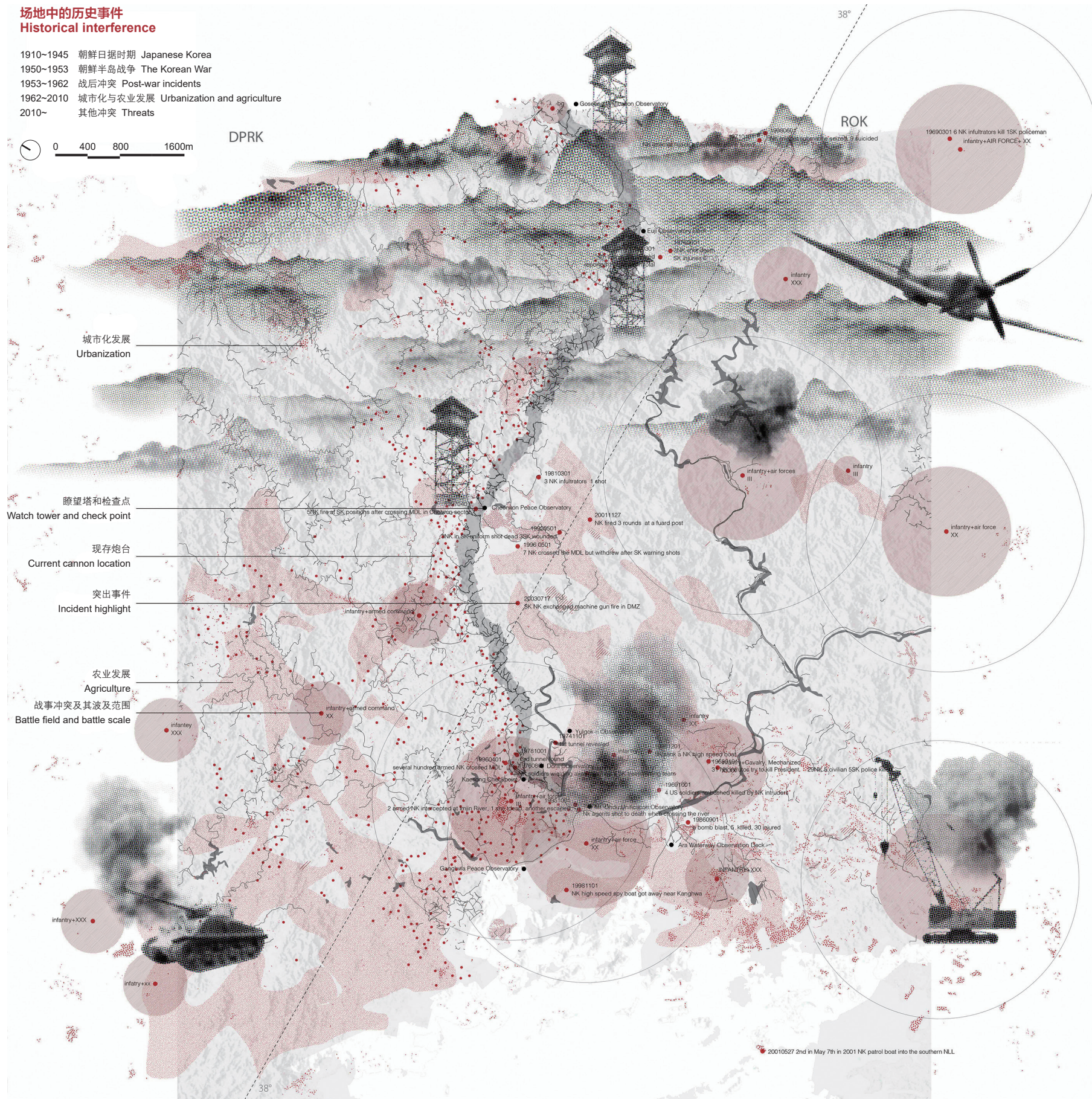
瞭望塔和检查点
Watch tower and check point

现存炮台
Current cannon location

突出事件
Incident highlight

农业发展
Agriculture

战事冲突及其波及范围
Battle field and battle scale



8. 学生陈嘉雯的设计方案对DMZ中的主要历史地标进行了分析。
9. “朝韩50年”方案强调地雷的清除要先于黑色旅游开发。
8. Historical interference of DMZ in the design proposal by student Chen Jiawen.
9. In "Korea 50," the development of dark tourism must be after landmine clearance.

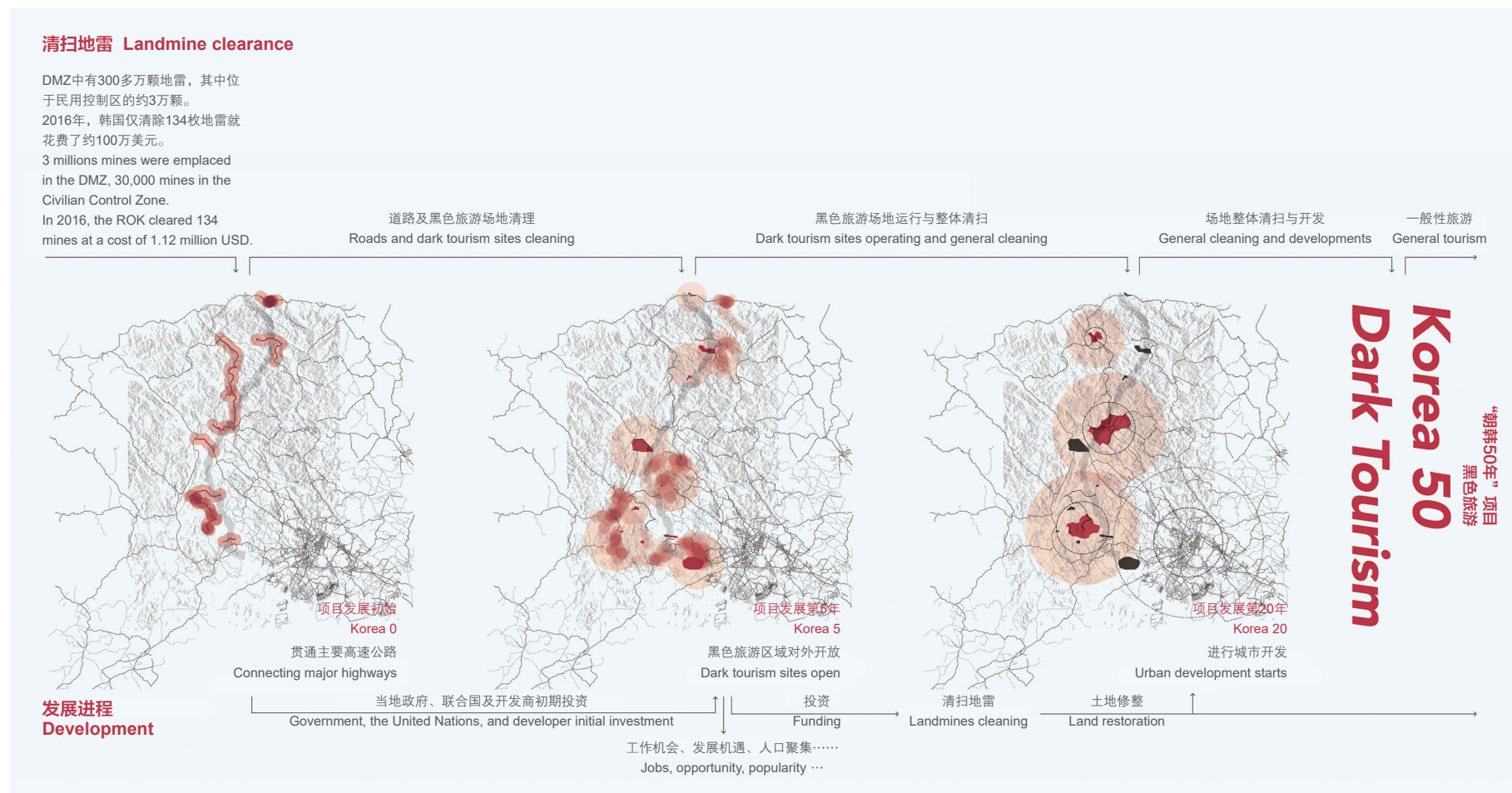
to brownfield land remediation and reuse is possibly unique to the planning and design professions and produces a range of creative and yet practical solutions. It was a key ambition for the students and faculty instructors that the studio focused on brownfield planning and design as a medium of investigation and invention rather than the political, legislative, humanitarian or military circumstances of reunification. In addition, unification was to be initially studied, delineated, and represented through site geology, hydrology and soils, and natural and mechanical remediation approaches rather than through the current approaches to building new infrastructure, ecologies, and communities. In summary, the key hypothesis underlying the studio was based on the unification of the Korean Peninsula initiated by the re-inhabitation of the DMZ and Hinterlands during and after remediation.

3 Study Area

For the DMZ, many design proposals have been put forward for example to conserve or preserve the larger area as a national

park, nature reserve, as a memorial for world peace or as a legacy of the 1950 ~ 1953 Conflict. However, the DMZ has been the focus of continuous harmful operations, exploitations, and pollution by the ongoing military operations in the zone. According to a United Nations Environment Program report, large-scale multiple vegetation burn scars linked to surveillance operations have been observed as well as the presence of in-ground soil and water pollution arising from military actions past and present.

The DMZ is a continuous military installation about 250 kilometers long from west to east and 4 kilometers wide making it a large brownfield in area as well as prominence. In land area it is the equivalent of 250 times the size of Central Park in New York City or one third of the size of Yosemite National Park, making it as significant a landscape as these two other iconic locations. Most of the DMZ are closed to the public and access, if at all, is highly restrictive. The brownfield conditions of the entire DMZ cover all manner of organic and non-organic pollutants. One particular type arising from the breakdown of subgrade anti-personnel mines that have leaked chemicals over



time mixing with surface runoff and sediments.

There are also various boundaries, lines, and zones on the maps of the Korean Peninsula that resulted from the military conflict in the early 1950s and with varied pollutions. For example, the Northern Limit Line^② contains a number of naval related brownfield sites where shipyards and oil terminals were located. The Military Demarcation Line^③, the center of the DMZ, has a “cocktail” of contaminants associated with explosives, mines, and in-ground pollutants arising from troop equipment. In the Civilian Control Zone, an additional buffer zone approximately 10 kilometers wide, adjacent to the southern border of the DMZ, authorized citizens (40,000 residents living in 81 villages) to access and reside in the zone where they would not influence military operations and security to carry out daily agricultural activities. The brownfield character is partly based on pesticide and herbicide use in farming along with the full complement of in-ground and water-based pollutants in streams and drainage ditches. Finally in Panmunjom^④, a range of pollutants are found here in more concentrated amounts based on the high military activity on a daily basis. Among the pollutants are metals, oils, and PCBs from generators as well as munitions.

At the start of the design studio the study area was initially the entire Korean Peninsula from a geological, geographical, and territorial point of view. This encompassed the current DPRK, the ROK, the existing DMZ barrier / border and accompanying zones between the two countries along with a network of fortifications, guards, security sensors, electrified fences, live minefields, subterranean tunnels, village agriculture, abandoned and reauthorized military bases such as Camp Greaves and forest, estuary, and wetland tracts. The students initially working

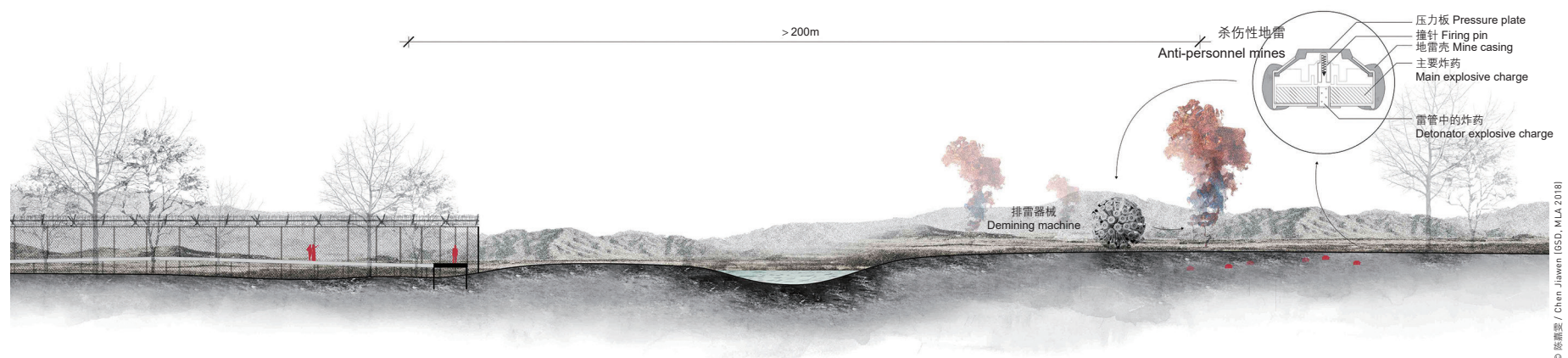
in groups redefined the concerns of pollution, security, border, and identity between the DPRK and the ROK using the sectional study of boundaries between ground surfaces, subgrade water bodies, and regional aquifers. Class members then advanced individual landscape site design proposals based on the themes of “Alternate Nature” where new types of landforms, ground covers, vegetation, and new drainage and circulation infrastructure are used to generate remediation approaches.

4 Study Methods

Following initial group research on the rethinking of the DMZ and Hinterlands boundary and its role in the unification process as a spatial mediator, class members conceived through individual design projects their landscape concepts and spatial and material elaboration of the term “alternative nature,” the use of more natural remediation techniques, the rationale for program after remediation, the economic viability of unification and its formal and spatial character. They also developed attitudes to risk-based planning within the constraints of a complex landscape fabric that continues to require or accommodate significant remediation and physical transformations over the next decade.

The contaminated ground surface of the DMZ and Hinterlands is the venue, medium, and method for tackling the complex history of the area and any future actions that will work to erase boundaries, breakdown barriers, and realign the ecology of the Korean Peninsula. This approach rejects the simplistic landscape preservation of the DMZ barrier as a pristine ecological reserve or as a venue for gratuitous architectural and artistic interventions and detached objects. It

- ② Northern Limit Line is the boundary line (sea boundary) designated by the United Nations Command in 1953 on the west and east seas of the Peninsula to define and limit patrol activities on water and in the air.
- ③ As a result of the Korean Armistice Agreement on July 27, 1953 when the conflict at the 38th parallel was suspended, the DPRK and the ROK agreed to withdraw each of their armies by two kilometers to the north and south respectively with the Military Demarcation Line as the centerline that divides north from south.
- ④ Panmunjom is a village on the border, close to where the 1953 Korean Armistice Agreement that paused the Korean War was signed.



10. 随着时间的推移，“黑色旅游”的收入将为常规的扫雷行动提供资金。
 11. 通过空中播种的方式进行景观修复与复原
10. As time goes on, the income of dark tourism would fund the general landmine clearance.
 11. Landscape restoration and recovery through aerial seeding

proposes to use “unification” as an intellectual, technological, and spatial landscape tool to remake the ecologies of the DMZ and Hinterlands based on advancing opportunities for addressing the legacy of pollution and the possibilities for human inhabitation as well as in the fabrication of innovative landscape infrastructure and design forms. This engaged a range of remediation technologies used in the evolving design processes of landscape especially related to soil removal, landform shaping, and hydrologic engineering of streams and rivers and took the form of new program venues for example to provide advanced clean industrial manufacturing and production, increasing non-polluting agricultural industries along with habitats for endangered species and ecological laboratories. The studio was broken into four parts over the length of the semester.

(1) Crossing to Safety

The legacy of landscape remediation planning and design and its contribution to the definition of the borders, boundaries, and the layout of complex land and territories were initially studied. The legacy of physical clean-up concepts was examined in relationship to the military installations as well as adjacent hinterlands. In particular explosives and propellant fuels were researched.

(2) Remade

Based on the work of Part (1), this next section aimed to reorder and regenerate the boundary of brownfield lands of the DMZ and its relationship to the hinterlands and adjacent lands. Case studies of other national military or political boundaries were investigated.

(3) Ground-Truthing

During the field trip to the ROK, the DMZ, and the surrounding context / hinterlands, the results of Part (1) and (2)

were ground-truthed by the students during site visits (Fig. 3) and the class took part in a workshop in Seoul on key issues related to the future evolution and unification of the Peninsula and its brownfield infrastructure.

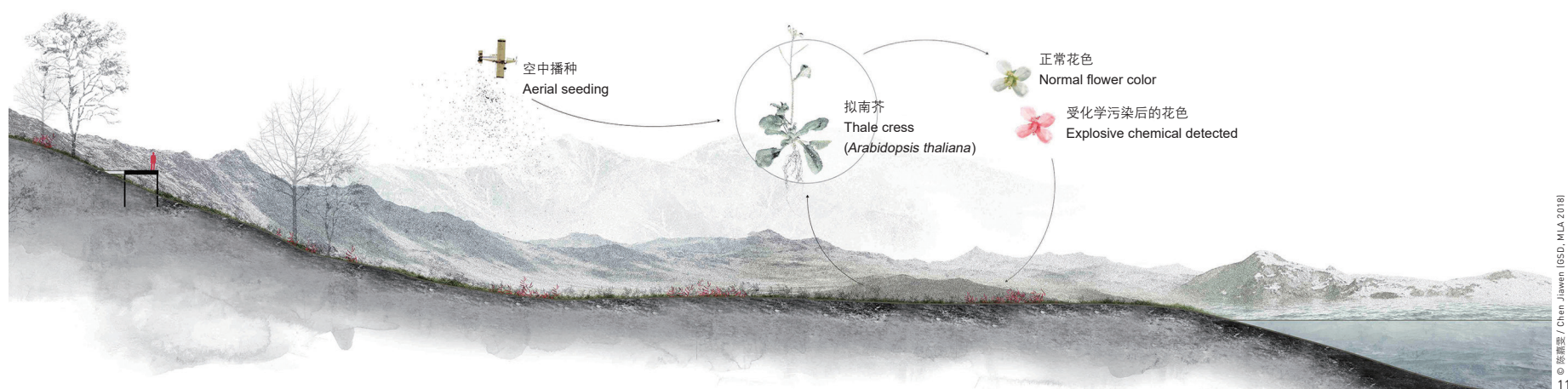
(4) Fabricating Alternate Nature

Following the field trip, class members advanced individual landscape site design proposals based on the theme of “Alternate Nature” related to brownfield lands. While previous studies of the DMZ have viewed this zone as a landscape of intrinsic beauty and terror, the studio aimed to challenge this legacy and explore this brownfield territory through the opportunities for human inhabitation, as well as natural remediation and engineering regeneration of infrastructure and energy.

5 Studio Outcomes

This studio initiative addressed brownfield remediation and regeneration design at the national territorial and global scale and the study area was a place of great topicality currently in terms of the world’s political, economic as well as environmental and regeneration stages. The students used this challenge as a way to create innovative programs related to industrial manufacturing and tourism to activate smaller, then expanded to larger, parts of the overall site study area. Two examples of the student’s work are now briefly outlined.

Student Gu Ran developed a post-unification regional structure for a national park system leading to individual project development proposals on the sites of former military bases for accommodating migration of citizens, manufacturing goods, serving tourists and facilitating social and cultural exchanges (Fig. 4).



The current condition of the military bases and military zone are as expected that of a range of intermixed brownfield types requiring different levels of remediation and recovery through “treatment trains” and a broad set of ecological planning approaches for their ultimate reuse over time (Fig. 5). Munitions present on site pose the most obvious threat to the soils particularly in the top 60 cm where they have remained for up to sixty years. This situation has led to the deterioration and breakdown of the metal castings and the dispersal of explosives into the surrounding soils, which requires soil washing techniques onsite and ex-situ as well as soil removal techniques. In addition, munitions are also stockpiled in “disposal heaps” throughout the former base areas. Of varied levels up to 3 meters in depth, these have accumulated metals, oils, and RDX in the highly disturbed waste piles mixed with organic soils and building materials such as plaster, brick, and paint products. This “cocktail” of contaminants could be addressed through ex-situ remediation by sifting and sorting of the waste material and disposal of the most contaminated in capped mounds, removal of oils by chemical oxidation and bioremediation and biodegradation of RDX by the planting of specific phytoremediation grasses. Attention was also given to the fabric of existing military base buildings and infrastructure. This entailed the cleaning of walls and roof surfaces of asbestos, the removal off-site of window and door mastic sealants containing

PCBs as well as lead paint chips from pre-1970 timber and metal surfaces. The final project integrates the remaining structures and open spaces into a larger landscape accommodating non-military cultural and social programs (Fig. 6, 7).

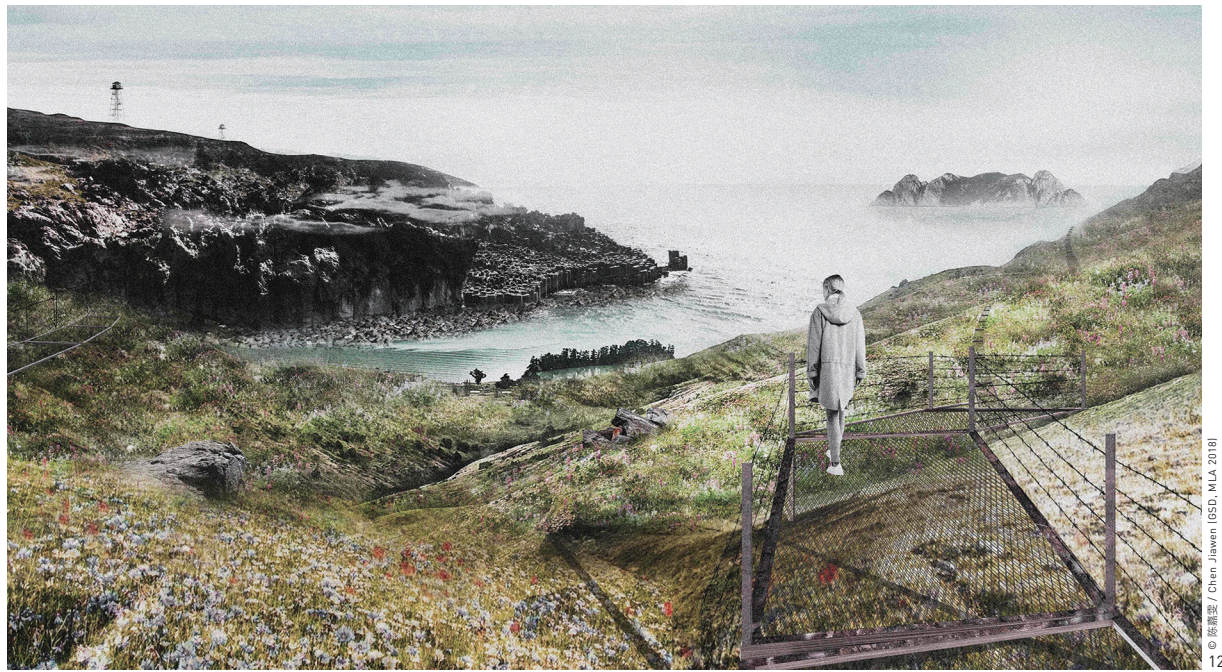
Student Chen Jiawen developed a project titled “Korea 50” for those visitors who were interested in “Dark Tourism.” This topic has been defined as travel and tourism to landscapes or sites associated over time with human or ecological tragedy and even death. Examples of these sites include former extraction mining sites and locations of war zones found in Europe and Vietnam such as the Chernobyl Nuclear Disaster Site in Ukraine. “Korea 50” thus engaged with the movement of visitors over the post-military sites making use of the war remnants to generate income to aid mine-clearing — the landmines needed to be cleared before any development can occur (Fig. 8). There are about 3 million landmines embedded in the ground, sediments, and water bodies within the DMZ, while in 2016, only 134 mines were cleared at the cost of approximately 1 million USD^[1] (Fig. 9). In order to support this very expensive and long-term process, the “Korea 50” program was a perfect match for the DMZ area, which had the necessary post-conflict conditions with surviving infrastructure and military archeology. The contents of “Korea 50” would use the unique geology and ecology as media and make use of the remnants of the war (such as battle field ruins, tunnels, watchtowers, and tank traps) to



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12. “朝韩50年”方案以当地独特的地质与生态环境为媒介，利用战争遗迹（如战场废墟、隧道、瞭望塔、坦克陷阱等）发展黑色旅游，从而实现记忆留存。
12. “Korea 50” employs the unique geology and ecology as media and makes use of the remnants of the war (such as battle field ruins, tunnels, watchtowers, and tank traps) to preserve the memories by developing dark tourism.



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12-2

preserve the memories. Since the sites of the “Korea 50” are relatively tiny and scattered, it only requires little investments and land at the beginning. As time goes on, the income of dark tourism would fund the general landmine clearance, and finally have enough land for other developments and general tourism. Ideally it could be accomplished in 50 years (Fig. 10 ~ 12).

6 Conclusions

Significant progress has been made by national governments regarding the conditions and environmental and military infrastructure and remnants to be found in borders or former boundaries such as between East and West Germany or between the Republic of Ireland and the United Kingdom of Great Britain and Northern Ireland or indeed between India and Pakistan. Each of these are unique politically, socially, and historically but display similar characteristics regarding the environmental condition of their infrastructure, soils, water or sediments from years of military use. However, there remains a lack of knowledge about this type of military border brownfield nationally and internationally and therefore the following are still relevant — How many brownfield borders are there in each region, country, continent, and globally and how can brownfield borders alter local economies and communities over the long term even those that have been tragically altered by cross border conflict with its human suffering and severe environmental

consequences. Examples of reuse and regeneration in academic studio studies have shown that in engaging environmental remediation, through infrastructure and over-time engineering and design, professionals possess a sure means of shaping the post-industrial and post-military border landscapes and in turn helping cities, regions, countries, and the greater world community. **LAF**

NOTE

For further information on the research and design initiatives at the Harvard Graduate School of Design, please contact with Professor Niall Kirkwood.

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