Slide 1: Title + Warm-up Dynamic

- **Title: Climate Change and One Health: Basic Concepts**
- Content:
  - **Definition of One Health: human, animal, and environmental health are interconnected**. This approach **shows clear advantages for adapting to and mitigating climate change** compared to conventional public and animal health methods. It highlights the urgent need for mechanisms to **work better together and to communicate fully between the involved sectors of human health, animal health and environmental heath**.
- Activity:
  - Mentimeter Poll: "What is the biggest climate-health challenge in your area? (e.g., zoonoses, food security, mental health)".
- Visual:
  - Word cloud displaying responses from the poll.
- Transition:
  - "Let's explore how climate change intensifies health risks."

Slide 2: Climate Change as a Threat Multiplier

- Content:
  - Climate change acts as a threat multiplier, intensifying various risks to health.
  - **Three Main Impacts:**
    1. **Spillover of zoonoses** (e.g., deforestation can lead to increased contact between wildlife, like bats, and humans). **Emerging vector-borne diseases** are a concern with changing climates. Zoonoses are also a risk in the context of livestock production, particularly with intensification. Alternatives to conventional animal protein may confer a lower risk of infectious disease.
    2. **Extreme events** (e.g., floods can lead to waterborne diseases). The frequency and intensity of extreme events are influenced by climate change. Floods displace animals and can contaminate water. **Wetlands are a natural safeguard that can store water and reduce flooding**, but their loss increases vulnerability. Studies using benthic macroinvertebrates as bioindicators show urban channels, which receive surface runoff and sewage discharge, have highly polluted waters. This pollution is exacerbated during precipitation episodes, demonstrating how heavy rainfall, intensified by climate change, can worsen water quality issues.
    3. **Food insecurity** (e.g., droughts can lead to malnutrition). Climate change is a major driver of biodiversity loss, and **food systems depend on biodiversity and ecosystem services**. Droughts are already increasing in some regions due to climate change, altering water supply to forests. **Rising atmospheric CO2 levels have been shown to reduce the protein, zinc, and iron concentration in staple crops** like wheat, rice, and maize. A fall in fish catch can threaten human health. Addressing food security under climate change requires comprehensive scenarios involving climatic variables, food production, food demand, and land-use.
- Connection to Research:
  - **Indigenous communities often detect these impacts first, providing valuable insights**, with examples from Brazil and Canada. **Traditional techniques provide useful models for biodiversity policies**. **Spatial and sociodemographic factors predict the level of impact** of environmental changes and strategies on health co-benefits.
- Visual:
  - Map illustrating climate-health hotspots.
- Activity:
  - Exposure only.

Slide 3: Cultural Fire Management (Brazil)

- **Title: Lessons from the Amazon: Controlled Burns and Health**
- Content:
  - Traditional and cultural fire management practices, as used by indigenous communities, can help prevent larger, uncontrolled mega-fires and protect biodiversity. These practices contribute to the conservation and sustainable use of biological resources.
- Visual:
  - A Geographic Information System (GIS) image comparing indigenous territories with deforestation rates, potentially showing lower deforestation within indigenous-managed areas.
- Transition:
  - "Now, let's discuss!"

Slide 4: Group Discussion

- **Title: How to Incorporate Traditional Knowledge into Public Policies?**
- Content:
  - **Question for Breakout Rooms (20 min):** "You are an advisor to the Ministry of Health. Suggest a way to include indigenous knowledge in climate-health planning." This relates to incorporating indigenous knowledge and practices in conservation and climate-health strategies. Governments are already undertaking to facilitate the participation of indigenous peoples and local communities in policy development for conservation and sustainable use of resources. Many are implementing measures to protect traditional knowledge and require prior informed consent. Modern science is also adapting its procedures based on this knowledge.
  - **Challenges:** Capacity development of local governments and institutions is needed to effectively take on assigned duties related to implementing such policies, especially where decentralization is ongoing.
- Sharing:
  - 1-2 groups present their ideas.
- Visual:
  - Photo of indigenous people in Canada practicing controlled burns, highlighting traditional techniques in different contexts.

Slide 5: GIS in One Health

- **Title: Mapping Connections between Climate and Disease**
- Content:
    - Geographic Information Systems (GIS) and spatial data are valuable tools for understanding the links between climate change and health outcomes.
    - Examples include:
        - Mapping the expansion of vector-borne diseases as temperatures rise and vector habitats change.
        - Analyzing the spatial relationship between deforestation and malaria outbreaks in areas like the Amazon.
        - Identifying spatial hotspots where environmental changes have significant impacts on health.
    - Such tools are needed to overcome the challenge of linking environmental changes and specific populations for health impact assessments. Spatial factors predict the level of impact of environmental strategies on health co-benefits.
- Preparation for Demo:
    - "Next, we'll explore real data together!"
- Visual:
    - Screenshot of a disease risk map, potentially overlaid with climate or environmental data.

Slide 6: Hands-on GIS Activity

- **Title: Hands-on: Analyze the Data!**
- Content:
  - **Option 1 (Demonstration):** Show a project in GIS software like QGIS illustrating temperature data overlaid with disease vector distribution.
  - **Option 2 (Interactive):** Guide participants to use online platforms like **Mapbiomas** or **Global Forest Watch (GFW)** to explore and overlay different environmental layers. These tools allow visualization of forest loss and deforestation alerts.
- Question:
  - "What patterns do you identify? How would this help a veterinarian or public manager?" This exercise demonstrates how spatial analysis can inform practical decisions in animal health, public health, and environmental management within a One Health framework. It helps identify areas where populations might be exposed to environmental risks or benefit from conservation efforts, and pinpoint hotspots.

Slide 7: Land Use and Land Cover Change: Impacts on One Health

- **Title: Key Concepts and Real Cases**
- Content:
    1. **Definitions:** Understanding the difference between **land use** (human activities on the land, e.g., agriculture, logging) and **land cover** (the physical state of the land surface, e.g., forest, grassland) is crucial for analyzing environmental changes. **Forest management and grazing can have unexpectedly large impacts on vegetation biomass**.
    2. **Examples with Data:**
        - **Amazon: MapBiomas data indicates significant forest loss (20%) since 2000**, linked to malaria outbreaks in agricultural frontier areas. While tropical moist forests have decreased, global forest carbon biomass has increased, outweighed by increases in other biomes.
        - **Atlantic Forest (Mata Atlântica):** The remaining 12% forest remnants are highly fragmented, increasing human-wildlife contact and contributing to disease outbreaks like yellow fever in São Paulo.
        - **British Columbia (Canada):** Logging activities near indigenous communities have reduced animal habitats, altering ecosystems and potentially affecting human and animal health. **Urbanization (a type of land use) leads to the removal of green areas and increased pavement**, increasing urban runoff volume and intensity. This runoff, often containing domestic sewage and non-point source pollution, degrades water quality and affects aquatic life, presenting risks in recreational waters.
- Interactive Activity:
    - Mentimeter: "Which case surprised you most? (Amazon, Atlantic Forest, or Canada)".

Slide 8: Tools and Practical Analysis

- **Title: Tools and Practical Analysis**
- Content:
    1. **Live Demonstration:** Show how to use online tools:
        - **MapBiomas:** Compare vegetation cover maps of the Amazon between 2000 and 2023.
        - **Global Forest Watch:** Visualize deforestation alerts in British Columbia.
    2. **Guided Discussion:**
        - "How do these changes in land use and land cover affect emerging diseases?"
        - "What is the role of indigenous knowledge in conservation and mitigating these impacts?" Indigenous knowledge can contribute to conservation strategies.
- Group Activity:
    - **Task:** Using the data shown, groups propose one mitigation strategy (e.g., establishing ecological corridors in the Atlantic Forest). This encourages applying spatial data and One Health principles to real-world problems. Effective climate-health planning requires capacity building and ongoing monitoring and evaluation.

Slide 9: Scenario 1 – Floods and Snakes in the Amazon

- **Title: Crisis in the Amazon: Floods, Ophidism (Snakebite), and Diseases**
- Content:
  - **Scenario Text:** Increased frequency and intensity of floods due to climate change in the Amazon region displace animals, including snakes (increasing snakebite risk - ophidism), and contaminate water sources, leading to outbreaks of waterborne diseases. Floods from extreme events are becoming more severe with climate change. Loss of natural flood buffers like wetlands exacerbates these risks. Urban runoff and sewage discharge, which intensify with precipitation, are real-world examples of how water quality degrades during heavy rainfall.
  - **Task:** Create a One Health intervention plan for this scenario. Consider the roles and collaboration needed from veterinarians, biologists, GIS specialists, public health officials, and community members. **Intersectoral collaboration is key to One Health approaches**, particularly between medical and veterinary communities. Mechanisms for better communication are a high priority. Designing effective interventions often involves **interdisciplinary teams and consensus-based approaches**.
- Visual:
  - Photo of a flooded forest.

Slide 10: Scenario 2 – Arctic Thaw and Zoonoses

- **Title: Outbreak in the Arctic: Pathogens from Permafrost**
- Content:
  - **Scenario Text:** The thawing of permafrost in the Arctic, driven by climate change, releases ancient bacteria and viruses that have been dormant for centuries. These pathogens can pose risks to human and animal populations. **One Health approaches are considered a strategy for resilience in a changing Arctic**.
  - **Task:** List three priority actions for addressing this emerging threat. Think about surveillance, community engagement (especially with indigenous communities who are directly affected), and policy development. **Integrated surveillance and response systems** are critical for climate change-related emerging diseases. **Modern communication technologies, like mobile devices**, can assist in the early detection of zoonoses, enable near real-time data collection, and send alerts. Engaging with stakeholders, including indigenous communities, and building capacity are essential for effective planning.
- Visual:
  - Infographic illustrating permafrost thawing and potential release of pathogens.

Slide 11: Quick Debate

- **Title: Should Indigenous Knowledge Become Public Policy?**
- Content:
  - Organize a quick debate (2 min prep, 3 min debate total) on the question: Should traditional/indigenous knowledge be formally incorporated into public policies, particularly in areas like climate-health and environmental management?.
  - **Arguments for:** Indigenous communities have valuable ecological knowledge and resilience strategies from long-standing relationships with their environments. Their practices often promote conservation. **Formal incorporation respects indigenous rights and is already being pursued by governments** as part of international agreements. Modern science is adapting its procedures based on this knowledge. Engaging with communities and understanding people is crucial for effective policy implementation.
  - **Arguments against (or challenges):** Integrating traditional knowledge into formal frameworks can be complex. Challenges include navigating different knowledge systems, ensuring respectful co-creation of policy with prior informed consent, and institutional barriers.
- Poll:
  - "Who convinced you? Vote now!"

Slide 12: Summary and Resources

- **Title: What Will Be Your Action?**
- Content:
  - **Synthesis:** Recap the main lessons learned: the critical links between climate change and health within the One Health framework, the utility of GIS and data tools for analysis and mapping, and the importance of indigenous knowledge and traditional solutions for resilience and conservation. Remember that even with technology, social understanding is vital for successful implementation.
- Activity:
  - Padlet Activity: "Share one thing that you will do differently or one action you will take after this class." Call to action: **spread the message** and **save us together**.
- Support Materials Mention:
  - Point participants to the direct links provided for further exploration:
    - **MapBiomas – Amazon (Collection 8)**.
    - **Global Forest Watch (GFW) – British Columbia**.
    - Mention any provided local data, such as Guaíba flood and soy data (from original plan).
  - Mention the need for **financing for capacity building, training, workshops, awareness agendas, and education** at the local community scale to support action.