FROM GREEN INFRASTRUCTURE AT KINDERGARTEN YARDS TO MICROBIOME AND HUMAN IMMUNE RESPONSE – DO ACTIVE NATURE CONTACTS REALLY MATTER?


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KINDERGARTEN YARDS, MICROBIOME AND HUMAN IMMUNE RESPONSE?


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IMMUNE MEDIATED DISEASES

• Microbes largely missing in urban areas

• Unless microbes modulate immune system

→ attacks against own cells or harmless particles
ADELE – strategic research opening

Over 20% of people in welfare states suffer from allergies, asthma, diabetes and other autoimmune diseases.

Risk of these diseases is decreased by a dog or a big brother as these serve as a rich healthy microbial cocktail for You.

ADELE will develop a safe way to enjoy the immunological benefits of natural environment.

Urban environment supports immune system development
ADELE-RESEARCH

How greening affects children’s health and well-being in urban environment?
WHAT DO CHILDREN MISS?
SOIL MICROBIOTA

1 g organic forest soil = 1 000 000 000 bacteria
Fungi, viruses, bacteriophages, Archaea, microscopic animals… (< 1000)
1 g EU sand: 10 000 bacteria
→ Sand gives 0.1 – 0.01 % as much as forest soil
URBAN < RURAL

- Senior citizens

- Bacterial diversity lower in urban areas

- Built area reduces doormat diversity

- Parajuli et al. submitted
RESEARCH QUESTIONS

• 1) Children’s microbiota and immune system?
• 2) Physical exercise?
• 3) Nature relationship?
• 4) Perceived well-being?
• Nature kindergartens (3)
• City kindergartens (6)
• Intervention kindergartens (6)
• 1 month in three cities
• Ca. 100 children
• Follow-up study in Lahti and Espoo in 2017–18
RESEARCH DATA

- Microbial samples (skin swabs, stool and saliva)
- Blood samples
  - < 60 children (2016)
- Survey data
  - 33 employees (2016–17)
  - 100 parents (2016–17)
- Interview data
  - 18 employees (2017)
  - 14 children (2017)
<table>
<thead>
<tr>
<th>Affordances</th>
<th>Environmental qualities that support affordances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diverse excercise</td>
<td></td>
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<tr>
<td>Rolling</td>
<td>Sod, forest floor vegetation</td>
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<tr>
<td>Creeping, crawling</td>
<td>Sod, forest floor vegetation</td>
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<tr>
<td>Turning somersaults, cartwheels, other tricks</td>
<td>Sod, forest floor vegetation</td>
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<tr>
<td>Jumping down/over</td>
<td>Sod, forest floor vegetation, peat blocks</td>
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<tr>
<td>Walking on the 'bridge'</td>
<td>Peat blocks</td>
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<tr>
<td>Playing tag/other games</td>
<td>Sod, forest floor vegetation</td>
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<tr>
<td>Playing ball games</td>
<td>Sod</td>
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<tr>
<td>Gymnastic exercises</td>
<td>Sod</td>
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<tr>
<td>Throwing</td>
<td>Peat blocks</td>
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<tr>
<td>Climbing, swinging</td>
<td>Sod, forest floor vegetation (soft ground)</td>
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<tr>
<td><strong>Embodied, multi-sensory experiences</strong></td>
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<tr>
<td>Touching, lying on the ground</td>
<td>Forest floor vegetation, sod, peat blocks</td>
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<tr>
<td>Smelling</td>
<td>Forest floor vegetation, sod</td>
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<tr>
<td>Tasting, having a picnic</td>
<td>Planters, sod, forest floor vegetation</td>
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<tr>
<td>Listening to sounds, making sounds</td>
<td>Forest floor vegetation</td>
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<tr>
<td><strong>Environmental education, building relationship with nature</strong></td>
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<tr>
<td>Searching for bugs, worms, snails</td>
<td>Forest floor vegetation, sod</td>
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<tr>
<td>Observing, wondering</td>
<td>Planters</td>
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<tr>
<td>Planting, taking care of the plants</td>
<td>Planters</td>
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<tr>
<td>Identifying species</td>
<td>Forest floor vegetation, planters</td>
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<tr>
<td>Learning concepts related to nature</td>
<td>Planters</td>
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<tr>
<td><strong>Inspiration for play</strong></td>
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<tr>
<td>Building (walls, fortresses etc.)</td>
<td>Peat blocks</td>
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<tr>
<td>Playing with toys (animals, cars etc.)</td>
<td>Forest floor vegetation, sod</td>
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<tr>
<td>Playing home, 'cooking'</td>
<td>Forest floor vegetation, sod</td>
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<tr>
<td>'Camping', 'hiking'</td>
<td>Forest floor vegetation, sod</td>
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<tr>
<td>Playing Kim games</td>
<td>Forest floor vegetation, sod</td>
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<tr>
<td>Other play which utilises natural materials (rocks, sticks)</td>
<td>Forest floor vegetation</td>
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<tr>
<td><strong>Art and crafts</strong></td>
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<tr>
<td>Doing an work of art</td>
<td>Forest floor vegetation</td>
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<tr>
<td>Doing crafts</td>
<td>Forest floor vegetation</td>
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</tbody>
</table>
EFFECTS OF GREENING OF YARDS

- More exercise
- Diverse exercise
- Creative play without toys
- More touch with natural materials with different senses
- More information about nature

→ New useful working tool for kindergarten teachers and nurses
EFFECTS OF GREENING OF YARDS

+ mood, energy, motivation
+ learning, concentration
+ air quality
+ nature relationship

→ Environmental responsibility

Green space has motivated children to more active play and using and examining natural materials in their play. They have spontaneously become inspired to examine and sense nature and changes in nature. Children enjoy the green yard more and have more ideas for play; green space has enriched children’s play. They like the soft ground under the climbing apparatus and to play, lie and roll on the sod.

Some children have very long days here. ---- They seem to be somehow energetic and lively in the yard. That is new for us. The contrast to the previous yard is so big that the effects can be seen here really quickly.
EFFECTS ON MICROBIOTA?

• Preliminary data available:
• After yard change skin microbiota changes
• Non-asthmatic
CONCLUSION

- Subjective well-being +
- Microbiota +?
- Cytokines not ready yet
- → health-enhancing yards
- maintenance ?
- safety regulations
- Please preserve green areas in cities
THANK YOU!

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